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NUMBER I

PERINEPHRITIC ABSCESS

A REVIEW OF CASES OPERATED ON AT THE MASSACHUSETTS GENERAL HOSPITAL FROM
1899 TO 1913¹

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Surgeon Out Patient Department, Massachusetts General Hospital, Surgeon Robert B. Brigham Hospital Assistant in Surgery, Harvard Medical School

THIS paper is based upon the cases classed as perinephritic or paranephritic abscess, 59 in number, operated on at the Massachusetts General Hospital during the fifteen years 1899 to 1913. For permission to report these cases I wish to thank the members of the staff of the hospital who operated on them.² Although perinephritic abscess presents a simple problem purely from the point of view of surgical treatment, yet the etiology is often obscure and the diagnosis in individual cases difficult. It is from the point of view of etiology particularly that I wish to consider the present series.

Included as perinephritic or paranephritic abscess are cases of varied origin and clinical course. Many factors make the determination of the probable source difficult. The long duration of the disease, the frequent inadvisability of completely exposing the kidney, the difficulty of determining the focal point in a large abscess cavity, the indefinite-

ness of clinical symptoms in renal disease limited to the cortex, may tend to obscure the cause of suppuration in any given case. Two large groups of cases may be made, first, cases in which the suppuration apparently originates in the perirenal fat primarily, and, second, those cases in which it is a continuation of disease from adjacent organs or structures. The latter class of cases may be divided into the secondary to disease of the kidney and those secondary to disease of other adjacent organs or tissues, particularly the intestinal tract, spine, ribs, or pleura.

This fact stands out in the majority of reported series. In many cases, and perhaps the majority, there is no definite local source for suppuration to be found, whether in the kidney or in adjacent organs or structures. It is the etiology of this group of cases, those of concealed origin, that I wish to discuss.

In this group, sometimes called primary cases, we have three possible sources of suppuration: first, through the lymphatics, second, through the blood stream by metastatic infection, and, third, from overlooked renal lesions. Trauma may be an important contributing factor, whatever the source of

¹ These cases were operated on by the following present and past members of the Staff: Dr. F. G. Balch, Dr. H. H. A. Beach, Dr. G. W. W. Brewster, Dr. W. A. Brooks, Dr. A. T. Cabot, Dr. Hugh Cabot, Dr. E. A. Cochran, Dr. E. A. Codman, Dr. W. M. Conant, Dr. Lincoln Davis, Dr. J. W. Elliot, Dr. H. B. Greenough, Dr. F. B. Harrington, Dr. A. J. Minter, Dr. J. G. Mumford, Dr. C. A. Porter, Dr. C. B. Porter, Dr. L. L. Scudder, Dr. M. H. Richardson, Dr. Hugh Williams.

² Deceased.

¹ Read before the Southern Surgical and Gynecological Association, Asheville, North Carolina, December 16, 1914.

infection, through producing hæmorrhage in the fat capsule or some other point of lowered resistance

The possible lymphatic origin of perinephric suppuration is obvious. The communication of the lymph vessels of the cortex with those of the perinephric fat through the fibrous capsule, of the ureter with those of the kidney and bladder, the connection of the lymphatics; of the perinephric fat with those of the diaphragm, the further connections through the lumbar, iliac, and hypogastric nodes, suggest many possible sources of infection. Stewart (1) and Sweet and Stewart (2) have shown the great importance of ureteral lymphatics in ascending infections of the kidneys and perinephric tissues. Miller (3) has emphasized the importance of the anatomical relation of the perinephric fat to the lateral lumbar glands.

There is also evidence, both clinical and experimental, in favor of metastatic infection of and suppuration in the fat capsule through the blood stream. This might take place either directly, through the vessels of the fat capsule itself, or indirectly, through the formation of lesions in the renal cortex or fibrous capsule, with rupture or extension into the perirenal fat.

Bacteria, injected into the blood stream of animals in sufficient quantities, are excreted in part by the kidneys. This is probably a pathological rather than a purely physiological phenomenon. Brewer (4 and 5) showed that if the resistance of one kidney were lowered by such factors as trauma or interference with the circulation, septic infection of that kidney might follow the injection of pathogenic bacteria into the blood stream. Injecting the staphylococcus, J. Koch (6) found that the toxins of the bacteria themselves, and Rehn (7) that a short chloroform anaesthesia, was sufficient to lower the kidney resistance and permit the occurrence of a septic nephritis with local renal abscesses, frequently subcapsular. On account of the lack of a definite fat capsule in animals, such a septic hæmatogenous nephritis rarely results in perinephric abscess. Schnitzler (8) found that such injection, followed after weeks by trauma, caused perirenal suppuration.

Clinically the occurrence of hæmatogenous septic nephritis has been brought to general attention by Brewer. It is well to remember, however, that such infection, as well as occurring in the form of fulminating cases demanding nephrectomy, and mild cases subsiding without operation, may produce local abscess of the kidney. Such abscesses are usually cortical, frequently single, and due to the staphylococcus in a great majority of cases. They tend to rupture into the perirenal fat rather than into the pelvis, and through extension may be the source of perirenal abscess. Their clinical symptoms may be indefinite, and they may produce either no change in the urine or so slight a change that it is overlooked. Consequently it is impossible practically to classify perinephritic abscess cases as renal or non renal through urinary examination.

As further evidence of the possible metastatic origin of perinephric suppuration, either directly or through the agency of the kidney, we have series of cases of local cortical abscess of the kidney and of perinephric abscess due to the staphylococcus, following peripheral pus foci, particularly furuncles, carbuncles, and paronychia. This association, pointed out by Jordan (9 and 10) and Israel (11), has been followed by a series of cases reported by Jaffe (12), Cahn (13), W. Albrecht (14), F. Koch (15), Herczel (16), Müller (17), Rehn (7), Coenen (18), Baum (19), Hartzbecker (20), Zinn (21), Schnitzler (22), Friedman (23), and others. These authors agree that in such cases infection is metastatic through the blood stream, and that perirenal suppuration may be due to the rupture of a preceding cortical abscess. In this partial review of the literature, 108 cases are reported due to metastatic infection. In 9 of them the abscess was limited to the renal cortex; in 24, the perinephritic abscess was apparently an extension of a cortical renal abscess, in the remainder the source of suppuration was not demonstrable at operation. In these cases perirenal suppuration was preceded by furuncles 55 times, by paronychia or septic fingers 21 times, by carbuncles 10 times, by various local abscesses 11 times, by tonsillitis and septic wounds, each 3 times. In 21

cases showing ruptured or non-ruptured cortical abscess, the urine was stated to be negative 12 times. The usual infecting organism was the staphylococcus, occurring 32 times alone, once each with the streptococcus and the colon bacillus. The streptococcus occurred twice.

Rehn believes his experiments show the genesis of perirenal abscess in two ways: first, through primary cortical metastasis, with wandering of virulent organisms through the fibrous capsule and destruction of the same, and, second, through primary metastasis in the fibrous capsule itself, and that these results are fully applicable to man.

Now what evidence in favor of metastatic hæmatogenous infection do the present series of 59 cases present? For the purpose of this paper the cases may be divided roughly into three groups. First, cases which are due to direct extension of suppuration from neighboring organs or structures outside the renal fascia. In this group are five cases, two men and three women, with two deaths. Infection here was due to tubercular abscess, apparently pancreatic (death), to acute abdominal sepsis in a woman seven months pregnant (death), to retroperitoneal abscess following gangrenous appendicitis, to tuberculosis of spine, and to disease of the twelfth rib. These cases are properly classed as retroperitoneal or lumbar abscess, and need not concern us further.

In the second group are included cases with antecedent or predominant diseases of the kidney or urinary tract, excluding a past urethritis without sequelæ, a total of 20 cases, 6 males and 4 females, with 4 deaths. The youngest patient was 19, the oldest 57. By decades the ages were:

19 to 30 years	7 cases
31 to 40 years	4 cases
41 to 50 years	5 cases
51 to 60 years	4 cases

or 35 per cent of these cases were 30 years of age or under.

Culture from the pus from the perinephritic abscess taken in 8 cases gave no growth 5 times, bacillus coli, staphylococcus aureus, a bacillus with a streptococcus, each once.

In this group tuberculosis of the kidney

occurred four times with one death, one secondary nephrotomy and two secondary nephrectomies. Pylonephritis, apparently non-tubercular, occurred three times, with one primary and two secondary nephrectomies. Pyonephrosis was present three times, twice with stone, with 2 deaths. Divulsion of stricture of the urethra was followed by perinephric abscess in one case. In one case there were calculi and diverticula of the bladder, with deficient excretion from the kidney on the affected side. Three cases gave a history of repeated attacks of renal colic, and had passed stones by urethra. In one of these, nephrotomy and exploration of the other kidney was followed by death. One case showed stone by X-ray, but the kidney was not exposed at operation. In four cases the kidney was stated to feel diseased at operation, but particulars were not given. In some of these cases, suppuration was obviously due to direct extension from the kidney. In others, although the exact method of development is obscure, there is at any rate the possibility that the perinephric infection was dependent upon the condition of the kidney or urinary tract.

Hæmatogenous septic infection is, of course, not excluded from playing a rôle in these cases. The situation is simpler, if we limit consideration of the rôle played by it to the remaining cases. The present group of cases, although extremely important, need not for the purpose of this paper be discussed further.

After separating the above rough groups, 34 cases remain. This last group, many cases of which would formerly be classed as "primary," I wish to discuss more in detail, and will limit my remarks from here on to this group. Their common factor is, in general, absence of symptoms referable to the urinary tract. It is obvious that they may develop from infection brought from a distance by the lymphatics. What evidence is there of metastatic infection through the blood?

This group includes 33 males and 1 female. All cases recovered from operation. Their average age was 29, the youngest was 12 and the oldest was 56, 29 of them were under 40. Arranged by decades, the ages were as follows:

From 10 to 20 years	8 cases
From 21 to 30 years	11 cases
From 31 to 40 years	8 cases
From 41 to 50 years	3 cases
From 51 to 60 years	2 cases
	—
	34

or 62 per cent were 30 years of age or under.

The pus was examined in 21 cases. Thirteen cases showed staphylococcus aureus, 3 a staphylococcus, one each the streptococcus in mixed culture, the bacillus coli, an unidentified bacillus, and no growth. One case, with preexisting sinus, showed a streptococcus. If the infection were commonly from an intestinal source, we should not expect such a predominance of the staphylococcus in pure culture.

A few cases showed a possible source of infection in peripheral suppurating focus. The following case is an example.

CASE 1. T C, male, age 33, No 181,656, admitted March 21, 1912. History. Denies venereal infection. Three weeks ago had lymphangitis of left arm following cut on wrist. Twelve days ago slipped from a tree and "strained" left side. Four days later began to notice dull heavy pain in left flank. No definite chill. No disturbance of urination. Has been in bed two days. No vomiting. Has walked lame since pain has been present. Physical examination. Left thigh drawn up, abdomen soft, no costovertebral tenderness. Marked tenderness along lower border of ribs extending into left lower quadrant just above Poupart's ligament. No mass felt. On left wrist a linear scar one inch long. Just posterior to this are two furuncles, one discharging. Urine examination. Faint trace of albumin, a few leucocytes and red blood-corpuscles, white count 27,300.

Seen by Dr. Codman, and condition regarded as acute hematogenous kidney. No operation advised. March 26, blood culture negative. Temperature runs between 99° and 101°. March 29, tenderness in flank increasing.

April 1, operation by Dr. C. L. Scudder. Loin incision, opening abscess in kidney region containing non-offensive creamy pus. Kidney not seen or felt. Culture from pus: profuse growth of staphylococci.

Blood culture April 3, no growth. Urine entirely negative on eight examinations following first.

Good convalescence. April 18, discharged.

CASE 2. A boy of fifteen was confined to the house six weeks before entrance, by furunculosis. Two weeks later he developed a pain in the back and five days ago there was swelling in the right loin. The urine was negative on examination. Operation by Dr. G. W. W. Brewster showed a large

abscess posterior to the kidney, containing odorless pus, which on culture showed a staphylococcus.

CASE 3. This patient is said to have had pain in the back eight weeks before admission, coincidentally with boils of the head and neck. Operation by Dr. C. L. Scudder showed a small abscess outside of the kidney capsule. On culture the staphylococcus aureus was found.

The first two of these cases distinctly suggest a metastatic source of infection. The record in the last case does not show any lapse of time between the furunculosis and the onset of pain.

Two cases followed erysipelas (facial in one instance, not stated in the other), and one case a streptococcus infection of the shoulder-joint. In all three of these cases, however, the staphylococcus was found in the perinephric abscess. In one case lumbar pain followed a week after sore throat and cervical adenitis. One case followed influenza and one a bronchitis. No other infectious processes occurring within three months were mentioned. In spite of the frequency of suppurative lesions draining into the lymphatics in the neighborhood of the fat capsule, they have not been conspicuous in this group.

Trauma has not been common in this series, and was definite only in one other case, a fall on the back from a table.

It is impossible to state from the records to what extent cortical abscess of the kidney may have been responsible for perirenal suppuration in this group. One case showed an induration the size of a dime on the cortex, with a dimple and a superficial sinus in the center. This lesion distinctly suggests a cortical abscess, largely healed. This case is the only one of the 34 in which the kidney was completely exposed. In only 12 others was it felt in its relation to the abscess cavity.

The following two cases, not included in this series, suggest that perirenal suppuration may have been headed off by early operation. One, operated on the fourth day by Dr. Daniel Iiske Jones, showed abscess in the lower pole, about to extend into the perirenal fat. The other, operated on the fifteenth day by Dr. Lincoln Davis, showed a solitary abscess under the fibrous capsule. Both were due to a staphylococcus. In the second case the urine was entirely negative.

Both cases report themselves well ten and three years after operation.

Only 12 of the 34 cases showed an entirely negative urine before operation. Leucocytosis was present in all but one of the 34 cases. Blood culture was negative in 6 instances.

The type of onset varied from sudden sharp pain, suggesting in a few cases renal colic, to an insidious onset, in which the presence of a lumbar mass first called attention to the probable diagnosis. In 7 cases the onset was distinctly sudden, in 2 cases with an initial chill. Occasionally a period of remission followed.

Complications were few. Two cases had phlebitis, one pneumonia and otitis media. One case had a fecal fistula. One case required two operations, and one, three before the sinus finally closed.

Letters sent to these 34 cases gave fifteen replies. Twelve cases were well at an average of 6 years, 2 cases were well at one year, and 1 complained of weakness and bad kidneys at the end of one year.

Diagnosis is difficult in the early stages, and in general it may be said that operation is undertaken late. In this group, excluding 2 cases in which the duration of symptoms was 6 months, the average duration was 29 days. In 24 cases a palpable mass, often already pointing, was present. Cystoscopy, ureteral catheterization, and X ray, although essential in excluding disease of the urinary tract or spine, may be of no positive help in these cases. The three principal points in diagnosis are continued fever, leucocytosis, and abdominal or costovertebral tenderness.

The treatment in general in this series has been simply to drain, reserving further measures for a secondary operation. There were no deaths in the last group of 14 cases. The mortality for 50 cases was 10.2 per cent with no deaths from secondary operations.

To sum up a very few cases show evidence of a metastatic hematogenous infection. Whether this is direct or indirect either through metastasis in the fibrous capsule or through rupture of a cortical abscess is of small clinical importance, provided the possibility of coexistence of an imperfectly drained renal abscess is borne in mind.

In conclusion, without minimizing the importance of infection of the peritoneal fat from a distance through the lymphatics, and without implying the frequent participation of the kidney, I should like to call attention to the following points:

The commonest organism, the staphylococcus, producing "primary" perinephritic abscess is also the most frequent organism concerned in producing focal cortical abscess in the kidney.

"Primary" perinephritic abscess occasionally follows peripheral pus foci. In such cases it is reasonable to suppose that infection has followed a metastatic hematogenous course.

A urine normal on clinical examination does not exclude the possibility of cortical renal abscess.

The previous occurrence of a peripheral pus focus due to the staphylococcus may be of some importance in the diagnosis of continued fever with leucocytosis and lumbar or abdominal pain.

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NEW FACTS AND THEIR CLINICAL SIGNIFICANCE CONCERNING CANCER¹

BY WILLIAM CARPENTER MACCARTY, M.D., ROCHESTER, MINNESOTA

From the Mayo Clinic

IT has been definitely established that the cancer-cell apparently arises in certain organs from cells which are normally present, and have the definite normal function of replacing the functioning cells of the organ (1). They are the immediate offspring of the germinative cells of the parenchyma of these organs.

It has been further established that parenchymal germinative cells of some organs undergo certain morphologic changes in the presence of a chronic irritant or irritants and that these changes are similar in the breast,

prostate, skin, and stomach. The line of demarcation between the hyperplastic intra-acinic or intraglandular cellular changes and the extra acinic or extraglandular epithelial cells which are characteristic of carcinoma is not morphologically visible, the only difference being in the location of the cells; intra acinic or intraglandular hyperplastic cells have been considered to be non malignant and extra acinic and extraglandular hyperplastic epithelial cells to be malignant.

Normal functioning cells, hyperplastic intraglandular and intra acinic germinative cells and extraglandular and extra-acinic hyperplastic cells of carcinoma are frequently seen in the same field of the microscope (2).

It has been apparent that the most closely related cytologic picture to carcinoma is the intra-acinic or intraglandular hyperplasia, which has been termed secondary epithelial hyperplasia, and that this picture is the histologic condition which should be called the precarcinomatous or precancerous condition (3).

In 1913 I (1) described the stages of epithelial hyperplasia as primary, secondary, and

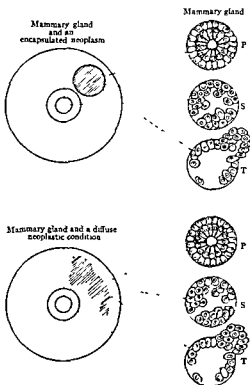


Diagram 1 Encapsulated and diffuse fibro-epithelial neoplasia showing the histologic pictures of primary (P), secondary (S), and tertiary (T) (carcinoma) epithelial hyperplasia

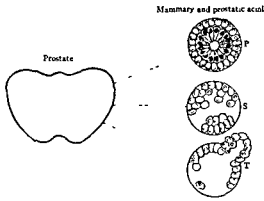


Diagram 2 The prostatic epithelium presents the same arrangement of cells with the same cytologic characteristics which are found in the breast. P, S, T, primary, secondary, and tertiary or migratory hyperplasia

¹ Read before the Southern Surgical and Gynecological Association Asheville, North Carolina, December 1914

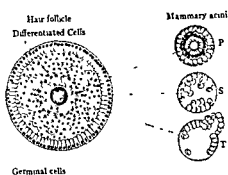
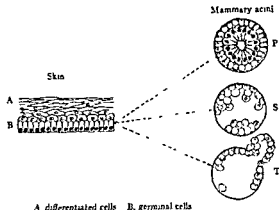


Diagram 3. The principal cytologic changes which occur in the hair follicle in chronic folliculitis are seen in the germinal cells, which present the same cytologic characteristics which are seen in the mammary acini when undergoing a condition of epithelial hyperplasia. P, S, T, primary, secondary, and tertiary or migratory epithelial hyperplasia.

tertiary, and during the same year presented (4) an application of these terms to the mammary gland

Since the terminology which I have adopted as a result of this investigation has proved simple and satisfactory in the case of mammary neoplasms, it has seemed advisable to extend the observations to other organs. The prostate, skin, and stomach have conformed absolutely to this histology and terminology. Such definitely defined terms as primary, secondary, and tertiary epithelial hyperplasia may be utilized in establishing a clearer understanding between the pathologist, clinician, and surgeon in clearly defining benign, doubtful, and malignant epithelial growths. The proposed method, however, involves the undemonstrated danger of spreading a malignant disease by wide excision, both pathologist and surgeon agreeing that incision of neoplasms is a bad and dangerous practice.

In doubtful cases wide excision of pathologic epithelial conditions produces a specimen which may be classified under three distinct and definite headings, each having a definite clinical significance, and that forming the basis of accurately defining the doubtful group of cases, which may be studied with the object of settling the correct operative procedures and the curative effect of operative surgery in its relation to epithelial neoplasms. It may be suggested, therefore,



A, differentiated cells B, germinal cells

Diagram 4. In conditions of chronic dermatitis one finds the most marked cytologic activity in the germinal layer of cells, which present the same cytologic characteristics which are seen in secondary and tertiary epithelial hyperplasia in the acini of the mammary gland. P, S, T, primary, secondary, and tertiary or migratory epithelial hyperplasia.

that such a specimen when removed by wide excision be classified as primary epithelial

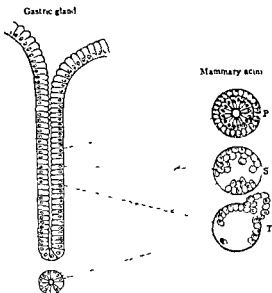


Diagram 5. The analogy between the observations of epithelial hyperplasia in the breast and those in the stomach. The location of the germinal cells in the gastric gland is at present uncertain. In the gastric gland two rows of cells are not seen as in the prostate, breast, skin and hair follicles. However, where the differentiated columnar or cuboidal gastric epithelial cells are normal, one sees in chronic inflammatory conditions certain cytologic pictures which are analogous to those which are seen in secondary and tertiary epithelial hyperplasia in the breast. P, S, T, primary, secondary, and tertiary or migratory epithelial hyperplasia.

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hyperplasia, secondary hyperplasia, or tertiary hyperplasia, the first being benign, the second being doubtful, and the third being malignant. (See diagrams 1, 2, 3, 4, and 5.) With our present knowledge the first condition requires only excision if anything, the second wide excision, and the third complete or radical removal.

In case the pathologist reports secondary hyperplasia, wide excision only is justifiable. It is this group which needs careful study because the exact outcome of such a condition can only be accurately determined by the post-operative histories of such cases. This fact puts the problem in a field of research which belongs to the surgeon and forces him

to standardize his operative procedures to histologic findings. Only by such standardization will the clinician, the surgeon, and the surgical pathologist be able to cooperate scientifically in their efforts to render justice to the patient.

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TRAUMA INTO AND ABOUT JOINTS¹

By C. E. CALDWELL, A. M., M. D., CINCINNATI, OHIO

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AT the risk of being too discursive, I have chosen the above title for my paper, as I wished to discuss certain features of joint injuries which have presented themselves in my own private and hospital practice. In some instances I have been able to arrive at definite conclusions as to the best methods of procedure, in others I am still left in doubt.

Whether one should or should not resort to operative interference in a given case of injury in the neighborhood of a joint is and will always be a matter of individual judgment, based on the results of individual experience in the treatment of that particular type of injury. It will prove difficult to standardize surgical skill, and the ordinary mortal can hardly hope to vie with the brilliant achievements of exceptionally gifted colleagues.

At the shoulder-joint a problem frequently presented for solution is the treatment of fracture-dislocations. Conclusions will be best reached by a discussion of the altered anatomical conditions and the manner in which they have been produced. It may be

assumed that when fracture at or near the anatomical neck of the humerus complicates a dislocation, force, in addition to that concerned in the production of the dislocation, has been more or less directly exerted at the point of fracture. To me the most plausible explanation is the following:

The patient falls with outstretched or abducted arm, and when the fall does not result in a Colles' fracture the force is transmitted through the rigid forearm and arm against the lower margin of the glenoid, against which it is held in closer contact by the contraction of the pectoralis, latissimus dorsi, and deltoid muscles. The force of the impact separates the head at the anatomical neck, and the line of cleavage may or may not include the greater tuberosity as a whole, or in part, with its facets of insertion for the supraspinatus, infraspinatus, and teres minor muscles.

Simultaneously with the separation of the head and the resulting tearing of the capsule, the shaft is pulled medianward by the pectoral and latissimus dorsi, and the head of the bone, should the line of cleavage have

¹Read before the Southern Surgical and Gynecological Association, Asheville, North Carolina, December 27, 1924.

included the insertion of these muscles, will be pulled upward and rotated outward by the contraction of the supraspinatus, infraspinatus, and teres minor muscles. This outward rotation of the head is shown in Fig 1, and when it is present it will be impossible, I believe, to reduce the head without operative interference.

Where the head has passed the margin of the glenoid toward a subglenoid or a subcoracoid luxation, or when simultaneously with such passage the tuberosity is avulsed, or what in its effect upon the head amounts to the same thing, that is, the line of cleavage is entirely through the anatomical neck, the head will remain unrotated either in the subglenoid position or subcoracoid, having been pushed into this position by the end of the shaft as it travels inward following the pull of the pectoral and latissimus dorsi muscles. In this position there may be a chance to effect reduction by pressure on the head through the axilla, traction and abduction of the arm being practiced by an assistant with the patient completely narcotized. The greatest care, however, must be exercised to avoid further damage to already contused vessels and nerves. In the face of the enormous extravasation present in some cases, such precautions are more readily advised than observed.

In case interference proves necessary, I am more and more inclined to advocate operation as soon as the diagnosis has been made, and the futility of efforts to reduce has



Fig 1 Fracture dislocation of the head of the humerus. Note external rotation of the head.

been demonstrated. I am not disposed to believe that there is one-half the danger of infection through freshly torn tissues that is present in tissue subjected to the devitalizing effect of pressure, and the toxic effect of blood ferments. If wait we must, let us wait until the tissues have regained their normal tone and the possibilities of effective arthroplasty are greater.

Even so early as a week after injury, the difficulty of reducing the head may prove insurmountable, and the removal of the head is the only thing left to do—a most regrettable alternative. In several instances—in two at least—where I have been forced to remove the head, after prolonged efforts to



Fig 2 Fracture dislocation of head of humerus. Arrow points to subcoracoid position of the head.



Fig 3 Fracture dislocation of the head of the humerus. Note subglenoid position of the head.



Fig 4 Same as Fig 3 after removal of head of humerus.



Fig 5 Rotation and subacromion position of head of humerus



Fig 6 Same as Fig 5, after removal of head of humerus



Fig 7 Fracture of surgical neck in patient aged 62, condition precluded operation

effect a reduction, I feel that there was much left to be desired in the usefulness of the arm. How long this disability will last I am unable to state. It is in part attributable to a lack of a sufficient fulcrum at the upper end of the humerus, the absence of a *point d'appui* for the supraspinatus, infraspinatus, and teres minor muscles, and also in part to conditions which obtain even after simple luxations of the shoulder, i.e., lacerations or paralysis of branches of the brachial plexus principally the circumflex nerve which winds around the surgical neck of the humerus in the most favorable position to be stretched or torn.

The danger of disability from this last-mentioned source, even in simple dislocations, should be anticipated and the patient prepared for such an event should it occur. We should always remember that results which are not satisfactory to the patient do not admit of *post facto* explanations. Patients are often more fair and reasonable than we from our prejudiced standpoint are willing to admit, and a timely setting forth of the possibilities in a given case may prevent much justifiable hard feeling where results do not measure up with expectations.

As to the viability of the head in cases



Fig 8

Fig 8 M M, age 9. Profile view 1 day after injury. Note comminution and obliquity of line of fracture.



Fig 9

Fig 9 M M, age 9. Anteroposterior view of elbow 9 days after injury. Note internal displacement of arm.



Fig 10

Fig 10 M M, age 9. Profile view of elbow two months after plating. Note bony overgrowth from torn



Fig 11

periosteum which is fast disappearing. Result almost perfect function.

Fig 11 M M, age 9. Anteroposterior view of elbow two months after plating. Note oblique position of plate to avoid bridging the olecranon fossa. Also slight projection over lower end.



Fig 12 O S, age 62 Comminuted fracture at elbow treated by reduction of fragments under anaesthesia and extreme flexion Result excellent



Fig 13 O S, age 62 Showing good position of fragments in a comminuted supracondylar fracture, by extreme flexion of the elbow Functional result excellent



Fig 14 Compound comminuted fracture of humerus and ulna Fragments removed at operation Pocket of pus found Result, stiff elbow

where it is preserved, personally I am inclined to believe that were skiagrams taken, not six months, but two years after the accident, we should find in many instances atrophy or even complete disappearance of the head. The observations on which such an opinion is based are not sufficiently numerous to be convincing, but time and a sufficient number of observations will demonstrate the correctness or fallacy of the opinion.

The above remarks apply only to fractures through the anatomical neck. The cutting off of the blood and nerve supply in these cases makes it particularly desirable that replacement should follow as closely as possible upon the injury in order that the blood supply may, if possible, be restored. A fragment of bone once completely detached from the blood and nerve supply is unlikely to preserve its vitality for long. Especially is this true when, as in the case of the detached head of the humerus at the anatomical neck, there is no periosteum to help it out. I am not ignorant of much of the literature on bone transplants, but fail to be convinced, by much of the evidence, of the permanent vitality of these transplants. Because certain epithelial structures continue to grow after death is no argument for the permanence of their vitality.

In one case I removed the head, which proved to be a mere concavoconvex lens of

bone which was too fragile to admit of nailing to the shaft.

Where the head can be reduced, sometimes mere suturing of torn periosteum suffices to hold it in place.

In spite of the most rigid asepsis in effecting reduction, it is perhaps asking too much to expect as free mobility in the shoulder as before the injury and it is difficult to fix the scapula so as to determine accurately the arc of mobility, but if for all practical purposes the range of movement is satisfactory to the patient, we may feel gratified by the result.

Chipping of the edge of the glenoid sometimes further complicates these cases. The best remedy for this is removal of the fragment. Uncomplicated fracture or avulsion of the greater tuberosity of the humerus has not in my experience required operative interference, although I am aware that it is the custom of not a few surgeons to fix them with nails or otherwise.

I have never found it necessary to operate in simple fractures of the surgical or anatomical neck, although I am aware that such operations are not infrequently advisable.

In fractures about the elbow-joint, we must distinguish sharply between those occurring in adults and in children. In children, hardly any fracture is so severe as not to offer hope of an ultimately satisfactory result.



Fig. 15. Fracture of external epicondyle, external condyle and 1/2 of olecranon process of ulna.

Fig. 16. Dislocation of humerus, base of scapula. Attempts to reduce before and after operation. Bone is moved. Results shown.

as far as function is concerned. Ankylosis is a remote contingency, and so far as the more gun-stock deformity is concerned it may in most instances be avoided by overflexion of the forearm on the arm.

In one instance only have I been obliged to resort to open operation to correct conditions which must inevitably have resulted in a crippled arm. This case is of sufficient interest to merit more detailed description.

M. M., girl aged 11, fell down bare feet, striking her elbow with great violence on a hard wood floor. On examination within a half hour after the accident the arm presented an immensely swollen and distorted appearance. Examination under chloroform discovered a fairly comminuted supracondylar fracture with great lateral displacement of the fragments. Flexion of the forearm of the arm resulted in water displacement of the fragments. The arm was therefore supported in an extended position on a posterior splint and an ice bag placed in contact with the elbow.

The following day I requested Dr. Sobey Large to bring a portable X-ray machine to the house and as a result of the findings in the pictures advised the removal of the patient to a hospital as soon as the condition of the arm would permit of operation. I was attracted in this case by motives of expediency, as I was not satisfied that the soft

tissues were in a condition to resist the effects of infection. Should I have another such case, I am sure I should advise immediate operation. I believe that the difficulties encountered would have been minimized by such a course.

Eight days after the accident I operated and found the difficulty in reduction such that I was obliged to make an incision larger than I wished to make for cosmetic reasons.

The difficulties of adjustment were increased by a rigid adherence to the rule of permitting nothing to come in contact with the wound but instruments and gauze on holders. The nurses were instructed and obeyed the instruction to pick up the needles and thread them with forceps. A small three-hole stainless steel plate was used to fasten the main fragment and caught sutures to hold the other in place by suturing the torn perosteum. It was exceedingly difficult to place the plate as may be seen by Fig. 17, so as to avoid bridging the olecranon fossa. This was finally accomplished by turning the plate all partly. This obliquity of the plate has caused a slight elevation of the skin at the outer side of the elbow, which in later years is any water of consequence to the young lady may be eliminated by removal of the plate.

The wound was closed with Michel clips, the marks of which at the present writing six months after the operation have almost disappeared. The patient has almost complete extension and flexion of the arm and perfect rotation. An obstacle to complete flexion exists in a bony overgrowth from

torn periosteum on the anterior surface of the humerus underneath the branchialis anticus. This is noticeably smaller than at first, and I am confident in time will entirely disappear.

In adults when the elbow shows great comminution, and the fragments are so disposed after attempts at reduction that they will inevitably interfere with function, it is obviously our duty to operate, and clear away such wreckage as cannot be made to serve a useful purpose in the reconstruction of the joint. While in most instances it will not be possible to secure even an approximately perfect function, we shall at least give the patient the best chance for it. A myositis ossificans developing in the proximity of the injured joint may exceptionally jeopardize the chances of a complete recovery of function.

Olecranon fractures, when not well approximated in extension, may require wiring or plating, or perhaps nothing further than suturing of the fibrous expansion of the extensor cubiti.

In the wrist I have come across a case of complete dislocation of the semilunar bone which, after repeated attempts to reduce before and after opening the wrist, I was obliged to remove, with perfect functional result.

At the ankle I have been obliged to plate



Fig 17

Fig 18

Fig 17 Compound comminuted fracture of tibia, result of motorcycle accident. Crushed the leg between machine and water trough. Conservative treatment. Patient discharged with good functional result in thirty two days.

Fig 18 Profile view of case of comminuted fracture of tibia, victim of motorcycle accident.

only twice it being impossible to bring the displaced lower fragment of the tibia into line. Ordinarily I have found the varus position of the feet with adhesive strapping most effective in reducing the displaced lower fragment of the tibia.

I have come across uncomplicated fracture-dislocation of the astragalus only once. The



Fig 19

Fig 20

Fig 21

Fig 19 Linear fracture of tibia into joint. A fracture easily overlooked. Showing the advisability of skiagraphing when possible since fracture would almost surely be overlooked otherwise.

Fig 20 Exaggerated Pott's including more than the

internal malleolus. Good reposition obtained by treating same in the varus position.

Fig 21 Fracture dislocation of astragalus. Attempts to reduce under anesthesia failed. Failure to reduce at operation. Astragalus removed. Result good.

pressure from the inner fragment threatened sloughing of the skin below the internal malleolus. All efforts to reduce under an anesthesia had failed. The bone was removed, and patient made a good recovery.

Occasionally, as the result of fractures into the knee joint, one or another of the tuberosities of the tibia become markedly displaced, thus altering the weight bearing surface of the tibia. In one such case I reduced and nailed the outer tuberosity, with an excellent functional result.

Displaced condyles of the femur are exceedingly difficult to manage whether with or without operation. In heavily muscled individuals this is especially true. I was unfortunate enough to get a deep infection in a case of compound fracture in which the first aid surgeon had neatly sewed up an infected skin wound. Fortunately it was sufficiently anticipated and the patient made a slow but good recovery after the removal of the plate.

Such an experience makes one alive to the occasional dangers which beset the path of

the too promiscuous and enthusiastic bone-plater. In many instances, treatment by extension and the double inclined plane, will secure a sufficiently accurate coaptation of the fragments to give the patient a good functional result.

I have not recently come across any fractures or avulsions of the tibial spines. In answer to the query of Mr Jones of Liverpool, as to whether we in America are not overlooking these cases, I may answer that we could not fail to see them in a good skiagraph and we skiagraph all our knee cases. It is not impossible that cricket, sprinting and other outdoor sports more universally engaged in in England and her colonies may have contributed to Mr Jones' unusual experience with this injury. Again, very few are fortunate enough to have the enormous material that is at Mr Jones' disposal.

As intimated at the outset this subject has been treated rather discursively, but my object was to jot down only a few personal observations and to invite general discussion for better enlightenment.

DIAGNOSIS OF ENTEROLITHS BY MEANS OF RÖNTGEN RAYS¹

WITH THE REPORT OF TWO CASES

By G. I. FAHLER, M.D. AND C. J. STORM, M.D., PHILADELPHIA

CLINICAL EVIDENCE

By C. J. STORM

AT the very beginning I might say that there is very little literature upon this subject, in fact but ten cases have been reported of which only one had been diagnosed before operation. This was discovered accidentally by Weisfogel² in 1906 who while searching for a uric acid stone by means of the roentgen rays found two stones in the appendix.

The symptoms in all of these cases correspond fairly well: pain at the site of the enterolith, intestinal disturbance, as nausea, vomiting and diarrhoea. The pain was usually exaggerated after the taking of food.

In the case reported by W. J. Hearn³ (1903) there was subacute intestinal obstruction due to a stone in the small intestines. The bowels moved but nausea and vomiting were present. The stone was removed at operation though not previously suspected.

J. M. Spellens⁴ in 1906 reported a case operated upon with G. G. Davis in 1903 when a hardened mass was removed extra-peritoneally through an incision close to and below the anterior superior spine. A sinus remained and five months later Davis found the sinus communicating with the appendix. The sinus and appendix were removed and the wound closed.

¹Hearn W. J. *Tr. Phila. Acad. of Surg.* 1903, 11, 106.

²Spellens J. M. *Ann. Surg.* Phila. 1906, 43, 5.

³Read before the section on General Medicine of the College of Physicians of Philadelphia, February 20, 1911.

⁴Weisfogel. *Fortsch. u. d. Geb. d. Röntgen* Hamburg 1906, 8, 21.

Wimmer¹ and Passini² in 1907, each reported one case, Zulawski³ one in 1909, MacHardy⁴ in 1910 and Graeve⁵ reported three cases in 1910.

In the cases reported by Spellissy, Wimmer, and MacHardy a palpable mass had been previously found.

The first case that we have to report has the following history.

Mrs. F. on March 24, 1912, complained of soreness in the right inguinal region, and in her endeavor to locate the pain found a rounded, freely movable mass, the size of an egg, in the right iliac region, tender to touch. A physician was called, a surgeon also in consultation, and operation was advised. This the patient refused.

I saw her that night. Examination by vagina and rectum failed to reveal anything abnormal. Abdominal palpation revealed a large, rounded, freely movable mass in the right iliac region, mass tender to touch.

X-ray examination was advised, believing that we had to eliminate movable kidney, tumor of the kidney, as well as stone in the ureter. After a thorough examination by Dr. Pfahler he determined that the mass was an enterolith. I might say in passing that the patient had had chronic constipation since childhood, and that during the two years immediately preceding this attack she had taken from one to two ounces of milk of magnesia daily to overcome the constipation.

The treatment in this case consisted of abdominal massage, glycerine and olive oil enemas taken twice daily in the knee chest position. On June 3, 1912, I removed the enterolith piecemeal from the rectum, as she could not expel it spontaneously. During the entire time that treatment was being instituted the only symptoms present were soreness and tenderness in the right iliac region. These have since disappeared.

RÖNTGENOLOGICAL EVIDENCE

By G. F. PFAHLER

In the past enteroliths have generally been found at operation or autopsy. Until recently a clinician could not do more than suspect them. Today, if they are suspected and a careful roentgen examination is made, they should be demonstrated, or if a thorough roentgen study is made they should be found even when not previously suspected.

Enteroliths in the vermiform appendix have been found accidentally during a

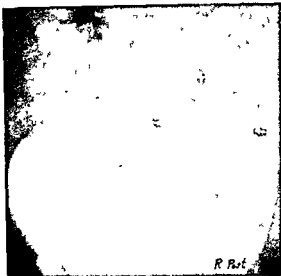


Fig. 1. Shows enterolith on the right side of the pelvis near the brim. Other plates showed this body lying over the ilium, then above the brim of the pelvis, and finally by bismuth injection was shown to be in the caecum.

roentgen examination for stone in the ureter, but the only instance in which I find a definite report of such a case is by Weisflog.⁶ He found two stones occupying the region of the appendix, which were movable. The patient suffered from some symptoms of chronic appendicitis. After operation, an analysis of the stones by Vogt showed them to consist of sodium phosphate, traces of iron, a small proportion of calcium carbonate, and mostly calcium of phosphates. These stones are very dense, and in this respect resemble very strongly urinary calculi.

Enteroliths in the appendix must be differentiated from

1. Phleboliths which are so often found in the pelvis. These are round, are most often found in the neighborhood of the spine of the ischium, are generally less dense in the center, have smooth and even surfaces, are often multiple and not infrequently found on both sides. The enterolith would be confusing only when it is small and located deep in the pelvis. I believe all appendiceal enteroliths are irregular or rough in outline, are less likely to be fixed and do not occupy the same plane as phleboliths.

¹Wimmer H. München med. Wchnschr. 1907 liv. 1032.

²Passini R. Riv. Med. Milano 1907 xv. 109.

³Zulawski. Przegl. Lek. Krakow 1909 xlviii. 132.

⁴MacHardy T. Edinb. M. J. 1910 n. s. iv. 439.

⁵Graeve. Lpzla. Läkzef. Fchr. 1910 n. s. xv. 488.

⁶Weisflog. Fortschr. a. d. Geb. d. Röntgen. Hamburg 1906 x. 217.



Fig. 2. Enteroliths in the appendix found during an examination for supposed ureteral calculi. By bismuth injection this was proved to be in the appendix.

2. Calcified glands. These are more likely to occupy a position near the spinal column, and to be located in a deeper plane in the tissues.

3. Genuine enteroliths in the bowel. These are rare, and likely to be larger. They are also less dense, and usually spherical.

4. Gall stones. These are likely to be less dense, and if located low in the abdomen are likely to be more movable. They also usually show a less dense center.

5. Ureteral stones. These will be the most confusing, because it is usually during a kidney and ureter examination that the appendiceal enteroliths are found. They can be differentiated by passing an opaque catheter into the ureter. They are also likely to be smaller in size and occur in line with the ureter. The ureter is only rarely displaced outward.

6. Foreign bodies, such as are swallowed by children or the feeble-minded. Their shape and density will usually serve to differentiate.

Finally, the enterolith can be definitely differentiated, when suspected by cleansing the bowel, then giving an opaque enema, filling the bowel and the appendix, and surrounding the enterolith with the opaque mixture.

True enteroliths occupying the bowel are more rare, and, so far as I can determine, the

case we report is the first to be recognized and definitely diagnosed. It is also the first to be removed without operation.

By personal communication I have learned of another case more recently diagnosed by LeWald of New York, and I am indebted to him for the privilege of showing his lantern slides with mine. This case will be reported in detail later.

She was a girl 12 years of age, had been constipated for years, and a peculiar oozing from the rectum caused annoyance by soiling the clothing.

By palpation, a mass was detected in the abdomen suspected of being a movable kidney, tuberculosis, lymph node, or a new growth. A roentgenographic examination of the urinary tract was negative. A bismuth meal study showed an elongated sigmoid flexure at the seventh second hour. A cleansing enema was given, after which a roentgenogram showed a large globular mass two and one quarter inches in diameter. The mass was removed by Dr. Hollis by rectal instrumentation.

In this case the enterolith was evidently rendered opaque by a deposit of bismuth from the bismuth meal. It probably could have been diagnosed at once by means of an opaque enema, in which instance it would have shown a filling defect.

Enteroliths within the bowel seem to be rare. They reach a considerable size, are globular in shape, are movable, and I believe generally would be only slightly more dense than fecal matter. They must be differentiated from—

1. Movable kidney. In both of the above cases this was the supposed diagnosis. A kidney shadow can usually be shown, is not globular in outline and of course does not occupy the lumen of the bowel, as could be demonstrated by opaque enema or injection of the colon with air.

2. New growths. These are not likely to be globular, nor movable, and if they occupy the bowel are apt to show characteristic serrations.

3. Gall stones. Large gall stones might be most confusing, as is shown in one of my studies. By means of a bismuth meal, or an opaque enema, it is likely, however, that these can be shown to lie outside of the bowel, as was demonstrated in a case of mine.

CASE REPORTS

CASE 1 Mrs F, age 40, had suffered from intestinal disturbances, chiefly associated with constipation, for years. She had been suffering from abdominal pain of a general character for a week, when one of us (Dr Stamm) was called, and by palpation a movable mass was found which was thought to be movable kidney.

A roentgen study was begun March 25, 1912. An examination of the urinary tract showed the kidneys normal in size, shape, and position, and also showed an abnormal mass only slightly opaque, about one and one half inches in diameter, occupying the pelvis, and then the iliac region.

This was suspected of being an enterolith. I first injected the colon with air, with the hope of more clearly outlining this mass within the lumen. This was a failure, I believe, because of an unsatisfactory fluoroscopic table, though the patient was stout. Injection of the colon with an opaque enema definitely showed this mass to occupy the cæcum. It moved both with the cæcum and within the ascending colon.

By means of glycerine enemata and manipulation this enterolith was partially dissolved and moved into the rectum, where it was broken by the finger and removed by Dr Stamm.

The following is a report of the chemical examination of the enterolith made by Professor George H Meeker of the Department of Chemistry of the Medico-Chirurgical College.

The enterolith consists mainly of magnesium phosphate. In addition to the magnesium phosphate the following substances were also identified: calcium phosphate, fats, traces of iron, minute seeds (possibly from the fig) and indefinite organic matter.

This case is of interest because it is probably the first which was definitely diagnosed and the enterolith removed from the cæcal region without operation. It is also of interest as an illustration of the methods by which such and similar affections can be definitely diagnosed.

CASE 2 Miss C, age 42, was referred by Dr LaPlace for roentgen study February 10, 1914. For three or four years she had been suffering from



Fig 3 Shows a gall stone lying partially over the shadow of the bowel and partially above it, at the hepatic flexure. This body was found to move around to a considerable extent, and finally was proved to be outside the bowel by the opaque enema.

headache and nausea. The attacks came on every seven to ten days, lasted about twenty four hours, and were relieved by vomiting. She had constant pain in the left lumbar region. At times she was tender over the appendix and at times became jaundiced.

Röntgen examination showed two opaque bodies in the right iliac fossa, about two inches outside of the usual position of the right ureter. Injection of the colon showed the bismuth surrounding these bodies in the appendix. They were removed by Dr LaPlace.

CONCLUSIONS

1 Enteroliths should be suspected when there is a movable mass in the abdomen, or when opaque bodies are found in the appendiceal region during the course of a roentgen examination of the ureters.

2 They can be definitely demonstrated by filling the colon with gas, or better by filling it with an opaque enema and demonstrating the mass within the lumen of the bowel.

3 By means of glycerine enemata and manipulation these enteroliths in the bowel can probably be removed without operation.

A NEW METHOD OF SECURING BONY ANKYLOSIS OF THE SPINE IN POTT'S DISEASE BY MEANS OF A BONE TRANSPLANT

By ALBERT I. HILSTEAD, M.D., I.A.C.S., CHICAGO

FIRST STEP With the patient in the lateral prone position, an incision beginning on the median line above the kyphos is curved around this prominence and terminates below at the median line. A flap of skin and fascia is reflected back to the spinous processes (Fig. 1).

Second step An incision is made along the lateral aspects of the tips of the spinous processes and extended for a distance of two vertebrae above and two below the diseased vertebra. With a sharp chisel the soft tissues, including periosteum and the erector spinae muscles, are separated from the lateral surfaces of the spinous processes well down to the vertebral arch (Fig. 2).

Third step After retracting outward, the tissue is separated from the spinous processes; the spines are sawed through at their bases

one above and one below the kyphosis as indicated in Fig. 3.

Fourth step The severed spinous processes, with the connecting ligaments, are strongly retracted to one side and away from the bases. The prominent bases of the spinous processes at the apex of the kyphos are cut away with a chisel (Fig. 4).

Fifth step A bone transplant is removed from the tibia in the usual way. The transplant is of sufficient length to reach from at least one vertebra above the diseased bones to one below. It is also fashioned so that it will have periosteum on one lateral surface and on one border. From the lateral surface the periosteum is reflected back to the border to which the periosteum is attached. The transplant may be held secure in a small vise

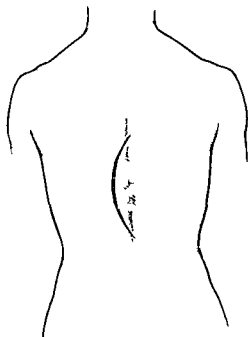


Fig. 1. Curved skin incision.

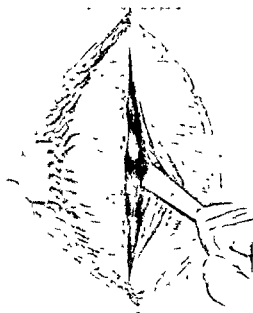


Fig. 2. Skin flap reflected; straight incision over the spinous processes; separation of periosteum and muscles from the sides of the spinous processes by means of a chisel.

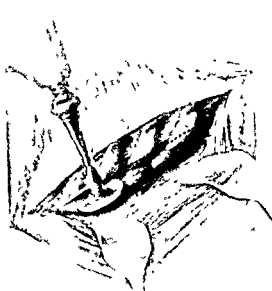


Fig. 3. Perosteum and muscles retracted, electric saw used to cut through the bases of the spinous processes.

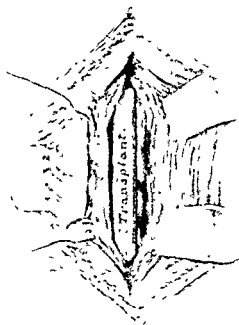


Fig. 5. Transplant with free border covered by perosteum is inserted between cut ends of spines.

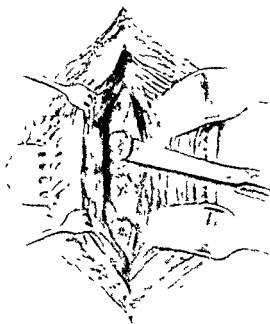


Fig. 4. Flap containing spinous processes and their connecting ligaments retracted, showing cut bases of spines; the most prominent are being cut down with chisel.

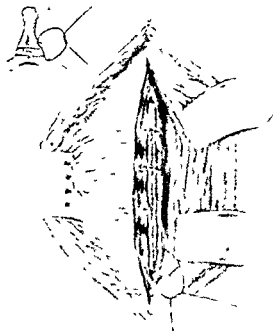


Fig. 7. A. Flap replaced. B. Transplant (labeled B) with sutures passed through perosteum of spinous processes of transplant, and perosteum and muscles at base of spines.

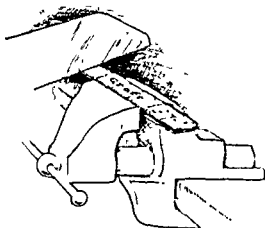


Fig 7. Method of preparing transplant. Note the small vise used to hold bone transplant while it is being shaped to suit conditions that are presented.

while it is cut to meet the requirements of the case.

The patient is now placed in the prone position and the transplant inserted between the cut surfaces of the divided spinous processes. The border of the transplant to which the periosteum is attached is toward the side from which the soft tissues have been retracted (Fig 5).

The transplant is held in place by replacing the retracted, detached spinous process, and secured by passing heavy chromicized catgut sutures through the periosteum of the de-

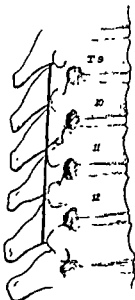


Fig 8. Schematic drawing showing method of placing bone transplant.

tached spinous process, the periosteum of the free margin of the transplant, and then through the periosteum at the base of the spinous process (Fig 6).

The deeper portions of the wound are closed by buried catgut sutures, and the skin by silk-worm-gut sutures.

The spine is immobilized by means of a plaster of Paris molded splint for ten weeks.

SPLENECTOMY FOR HÆMOLYTIC ICTERUS¹

A DISCUSSION OF THE FAMILIAL AND ACQUIRED TYPES WITH A REPORT OF SPLENECTOMIZED CASES

MEDICAL REPORT AND DISCUSSION

By CHARLES A. ELLIOTT, M D, CHICAGO

SURGICAL CONSIDERATIONS

By ALLEN B. KANAVEL, M D, CHICAGO

ON account of the general interest that has of late centered around splenectomy as a curative agent in certain diseases, notably pernicious anemia, biliary cirrhosis, Banti's disease, and hæmolytic icterus, and on account of the total absence in the American literature of case reports of splenectomy for hæmolytic icterus, we venture to report such a case as well as our conclusions resulting from the observation of a number of cases of this interesting affection.

We have observed three of a family showing the more severe manifestations of this disease, removing the spleen from one of these, four of a family presenting the less severe manifestations (Gilbert type), and one case of acquired hæmolytic icterus.

CASE 1. (A M B, family icterus, splenectomy) Wesley Hospital, No 52,418. Our principal interest centers about the case from whom the spleen was removed a clergyman of 54 years, who has suffered from attacks of illness associated with jaundice since 14 years of age. These attacks have been variously diagnosed — malaria for the most part, although there is only the most superficial resemblance to malaria suggested by the history or clinical findings.

The attacks (acholuric crises) have been very similar in their manifestations, as related by the patient the first occurring at the age of 14, at which time he had a short febrile attack associated with jaundice, which lasted about two weeks. At twenty he had "chills and fever" with jaundice, which continued all one fall. At 33 while a student at Evanston he had a febrile attack with malaise and much aching of the muscles associated with deep jaundice. The jaundice continued intense for some two years and he has never been entirely free from icterus of some grade since that time, some 21 years.

During this period he has been subject to recurrences of these attacks (acholuric crises) each of a few days duration at first recurring at intervals of months but of late recurring about every two weeks and becoming more intense in their manifestations.

These crises are similar, although variable as to intensity and duration. At onset the patient notices a general feeling of unrest, malaise, and lassitude. There is headache and aching in the muscles, with some tenderness in the upper abdomen, and a deepening jaundice. There may be fever, and of late he has noticed that the splenic tumor has become larger, standing up prominently in the abdomen during the acute attack. The urine is dark — a mahogany brown — and the stools are occasionally acholic, although not usually altered in appearance.

Aside from slight abdominal tenderness there has been no abdominal pain. His appetite has been good and digestion apparently perfect. There have been no stomach symptoms or signs of cholemia, such as pruritis and bradycardia, and the patient continues in a fair state of nutrition. Aside from an occasional nose bleed there have been no hemorrhages.

In January, 1914, an entirely different attack set in. This was heralded by gastric phenomena, loss of appetite, vomiting, and severe pain in the upper abdomen. He had chills and fever, with much tenderness in the gall bladder region. This continued for about a month, at which time a laparotomy was performed and a gangrenous gall bladder removed containing four pigment stones. The operation was performed as rapidly as possible without exploring the common duct.

One month after the operation there was a recurrence of the acholuric crises, without pain but with much jaundice. The spleen was noticed to be very large and became much swollen with each attack. Some of the more severe attacks were ushered in with dizziness and threatened unconsciousness, and were evidently becoming more severe in intensity. Ankle edema has been present during the height of recent attacks. There was much malaise and the patient was totally incapacitated for all forms of work.

Upon examination he appeared anæmic and markedly jaundiced of a light lemon color but there was no evidence of cholemia. The spleen extended some 20 cm. below the costal margin was firm and painless and presented a systolic murmur at the rib edge. It reminded one of a moderate leukæmic spleen. The liver was distinctly palpable, edge two fingers below the costal margin with

¹ Read before the American Surgical Association, Rochester, Minnesota, June 6, 1913.

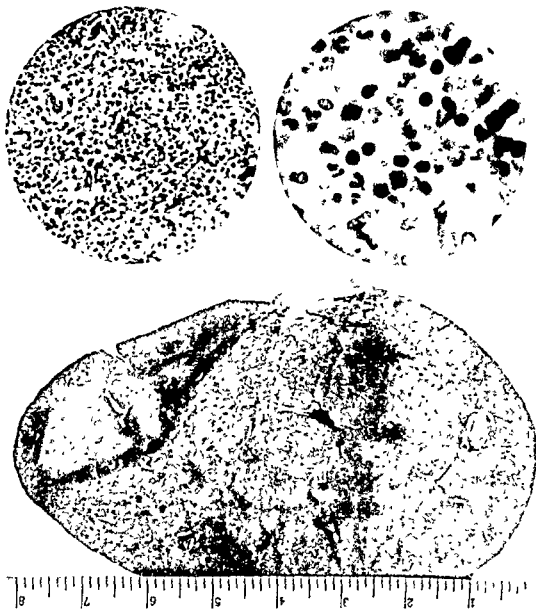


Fig 1 Cross section of spleen with microscopic sections. The dark colored areas in the gross specimen is due to fixation and is of no pathological importance.

a well marked right lobe extending well into the flank. It was only slightly tender upon palpation. The blood averaged, 4,000,000 red cells, 4,500 white cells, and 70 per cent hæmoglobin. Coagulation time 3.25 minutes. There were no nucleated reds or polychromatophilia. The stained smear reminded one of a moderate secondary anaemia and had none of the characteristics of pernicious anaemia. The Wassermann test upon the blood was negative, urine negative, blood pressure 128-78.

A fragility test of the red cells showed that they were less resistant to hypotonic salt solutions than normal hæmolytic beginning at 0.52 per cent and complete at 0.36 per cent sodium chloride solution, the normal beginning at about 0.44 per cent and complete at 0.28 per cent.

Upon the seventh day in the hospital one of the acholic crises occurred. He complained of lassitude, slight headache, and some tenderness in the liver region. The jaundice became markedly more intense and the spleen much swollen, standing erect in the abdomen to three fingers below the level of the navel. There was no fever nor an increase in the white cell count. A duodenal tube was in place at the time of the attack, and the duodenal juice withdrawn at this time was dark mahogany brown containing much bile pigment. The blood serum withdrawn at the height of the attack was cherry red in appearance (hæmoglobinæmia) and the fragility of the red cells showed hæmolytic beginning at 0.50 per cent and complete at 0.42 per cent sodium-chloride solution. The urine was heavily pigmented, giving positive tests for urobilinogen and urobilin and negative tests for bile pigments. There was no hæmoglobinuria. The stools were somewhat lighter in color than usual but could not be considered acholic. After 24 hours the jaundice began to fade.

Three days later an adrenalin test was made after the method of Frey and Lury and Abl. Ten minims of 1:1000 adrenalin solution was injected deep into the muscles, this producing a prompt reduction in the size of the spleen. In 40 minutes it shrunk from 27 to 21 cm in length and receded from 5.5 to 7.5 cm from the median line of the abdomen. It became visibly smaller, but 12 hours later had returned to the usual size. The fragility of the red cells was not affected by the experiment.

Operation. Wesley Hospital April 7, 1915. Operator, Dr Kanavel, assistants, Drs Hills and Stranberg. Anæsthetic, gas and ether.

The incision was made along the left border of the left rectus, extending from the umbilicus to the rib margin. Many adhesions were found about the upper pole, which were stripped off, one large band being ligated. Double clamps were placed upon the pedicle, the tail of the pancreas being excluded. The pedicle was cut and ligated with double ligature. Blood was taken from both artery and vein for fragility test. The artery was then tied separately. The liver was of bluish color did not look or feel cirrhotic. The wound was closed in layers.

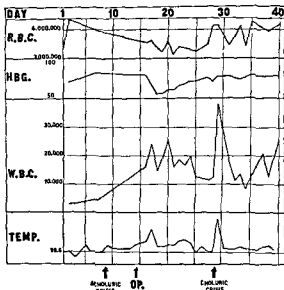


Fig 2 Clinical chart. At final count, ten weeks after the operation, the red blood cells were 4,248,000.

The post operative course was uneventful, except for an unexplained temperature on the second and third days, which subsided completely. There was also a cholic crisis later, as will be seen by a study of the chart.

Immediately following the operation the patient complained of pain at the tip of the left shoulder, which continued, gradually decreasing while he remained in the hospital, and which we ascribed to the disturbance incident to the breaking up of adhesions between the diaphragm and spleen, there being no evident disturbance in the chest.

There was a prompt increase in the leucocytes and a decrease in the red cells following the splenectomy, as was to be expected from the reports from Pierce's laboratory. The leucocytes continued high, averaging 15,000 to 25,000. Later the red cells began to increase in numbers, reaching 4,192,000 upon discharge from the hospital, upon the fortieth day, a higher count than at any other time while he was under observation.

There was a rise in temperature upon the second day following the operation, reaching 102°, which promptly returned to normal in 24 hours, a phenomenon following splenectomy that has been previously observed and commented upon (Muhsam).

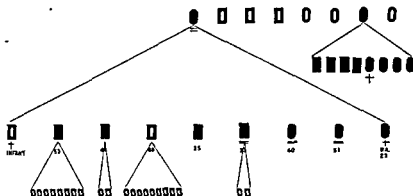


Fig 4 Genealogical tree of the "H" family See Fig 3 for description of signs

Professor Simonds reported on the microscopic picture, as follows:

The capsule and trabeculae are thickened. The smaller arteries show marked hyaline degeneration. The arteries and veins contain very little blood. The malpighian bodies are few in number and atrophic. None show typical germ centers. In some there are round or oval areas corresponding in size and location to the usual germ centers. These areas contain a few lymphocytes, but the majority of the cells composing them are either elongated cells with spindle shaped, palely staining nuclei (probably fibroblasts) or large, round, oval, or polygonal cells with oval or indented palely staining nuclei (probably endothelial cells). Mitoses are seen in both types of cells.

The splenic pulp is markedly atrophic. The capillaries and sinuses are filled with blood. The blood cells and the endothelium of the capillaries and sinuses make up almost the entire cell content of the pulp. There is very moderate increase of connective tissue.

Practically no large phagocytic cells containing red blood corpuscles or blood pigment are to be seen. Sections treated with potassium ferro cyanide and hydrochloric acid showed an unusually small amount of iron-containing pigment.

Numerous spaces varying from approximately 20 to 60 μ in diameter and probably corresponding to the pulp veins are seen in all sections. Most of them contain very little blood and appear as empty, or almost empty, round, oval, or elongated spaces lined with cells with very prominent nuclei. In a number of these veins there are hyaline thrombi, in others, there is a fine meshwork of fibrin containing a few red blood corpuscles and leucocytes.

Professor Kendall reports the following bacteriological findings:

Cultures, both aerobic and anaerobic, were made from the spleen of the patient in media, with and without blood and ascitic fluid. A slight growth appeared in dextrose broth after four days' in-

cubation, which proved to be a short bacillus, occurring singly and in pairs. Subcultures were obtained in dextrose broth for four generations, but large amounts of material — five cubic centimeters at least — were required to obtain successful growths in fresh media. After four generations the organism refused to develop, and attempts to inoculate other media were wholly unsuccessful.

Large amounts of culture — five cubic centimeters — were introduced into the ear vein of a rabbit and five cubic centimeters intraperitoneally into another rabbit with absolutely negative results.

No conclusions can be drawn from these experiments other than that the organism does not appear to be a contamination in the ordinary sense. Its relation to the lesion is wholly unknown.

CASE 2 (R B A, family icterus, 3 crises) The daughter of A M B (Case 1), who presents herself on account of jaundice. A young married woman, 22 years old, has always been well except that she has been more or less jaundiced and anæmic since childhood. As a child she had had many attacks thought to be "biliousness," during which she would become jaundiced, the attacks lasting about two weeks. She has had three severe crises during the past two years. The first crisis, January, 1913, was ushered in with intense headache, nausea, vomiting, and an intense jaundice. She was very sick for three weeks the jaundice remaining for six months. She states that she became very anæmic following this attack. The second crisis, November, 1913, started with an intense headache, which lasted five days, the jaundice, at first slight, became intense and persisted for 3 months. Following this attack she became more anæmic, was weak and easily nauseated, and the spleen was found to be much enlarged. Much of her hair fell out. The third crisis, December, 1914, less severe but similar to the previous attacks.

Examination, April 8, 1915, shows an anæmic appearing young woman, decidedly jaundiced but

well nourished. The spleen is very large, extending to one inch below the level of the navel. The liver is just palpable, but not tender. Red blood cells, 3,392,000, white cells, 7,200, hæmoglobin, 85 per cent. The fragility test shows that hæmolysis begins at 0.50 per cent and is complete at 0.38 per cent. The urine is negative, there being negative tests for bile pigments, urobilinogen and urobilin.

Splenectomy was advised but the operation deferred until the result of the operation in her father's case can be definitely known.

CASE 3. P. B., family icterus, slight manifestations. A healthy medical student, age 27 years, has never been seriously ill, but has had a "sallow complexion" all his life. Following a recent tonsillitis he became decidedly jaundiced. There is no history of critical attacks.

Upon examination he appears sallow, but there is no icterus. The spleen is palpable, extending one inch below the ribs on deep inspiration, and is tender. The liver is not palpable. Red cells, 5,184,000, white cells, 9,600, hæmoglobin, 100 per cent. Fragility test shows that hæmolysis begins at 0.50 per cent and is complete at 0.36 per cent sodium-chloride solution. The urine is entirely normal, there being a negative test for bile pigments, urobilin, and urobilinogen.

The "B" family, including the above three cases, is typical of hæmolytic family icterus, as previously described by others. In this family this affliction probably descends from the maternal great-grandfather. There are six of the second, seven of the third, and at least two of the fourth generation (the latter mostly children at the present time) who are supposed to have hæmolytic family icterus. It is significant that of the first and second generations none died under 60 years, and most of them lived to be 80 years of age or over, while of the fourth generation at least one died of "pernicious anemia" at ten years, one is intensely anæmic at 18 years, and one has intense crises and is in a poor physical condition at 22 years. It is also significant that there are those in a generation who are but little afflicted while the brothers and sisters are seriously afflicted with this disease. Apparently sex has no influence upon the disease in this family.

CASES 4 to 8. (Hæmolytic family cholemia, Gilbert type). This family "H," including four observed individuals, a mother and three adult children, present the manifestations of the mild form of this disease. Six of the second generation, that is, all who reached adult life except one, are sallow, have attacks of "biliousness" associated with jaundice of slight grade, are rarely markedly jaundiced, and none of them are markedly anæmic. The spleen is palpable in two, the fragility is increased in three, and there is a history of acholuric crises in two of the family examined. In this family the disease is supposed to come down through the mother, who is herself icteric, has an increased fragility and a palpable spleen, and of whose sisters one has eight icteric descendants.

It is significant that one of the second generation died at 29 with a diagnosis of pernicious anemia and that another has had a gall bladder operation. Of the others of this generation their ages range from 33 to 53, and they enjoy good health.

CASE 9. (C. L. W., acquired hæmolytic icterus). A student, 24 years of age, complains of extreme lassitude, rather constant headache, constipation, and jaundice of light grade but variable, of ten years' duration. He seeks relief in the belief that the lassitude is of intestinal origin.

Upon examination he is found to be but slightly icteric, the spleen is enlarged, extending 1.5 inches below the costal margin. The blood shows 6,524,000 red cells, 6,524 white cells, and 85 per cent hæmoglobin. The fragility of the red cells is increased, hæmolysis first appearing at 0.54 per cent and is complete at 0.32 per cent sodium-chloride solution. The urine gives negative tests for bile pigment, urobilinogen, and urobilin. The patient is under observation and splenectomy is being considered, since it seems to offer the only relief. This patient is partially incapacitated on account of the illness.

The fragility test of Chauffard and Vidal was carried out according to the Eppinger technique, and washed red cells were used for the most part, although this is not considered essential. There was obtained 10 ccm. of blood, which was defibrinated, centrifuged, washed in 0.6 per cent salt solution, again centrifuged, and 0.6 per cent salt solution added to make up to the original volume. Varying concentrations of hypotonic salt solution were arranged in a progressive series in small test tubes, ranging from 0.6 per cent to 0.3 per cent. This was readily accomplished by dropping 0.6 per cent salt solution from a burette, in diminishing amounts, and later dropping distilled water in increasing amounts, from the same burette, to make up to equal volumes. In the first tube 60 drops of salt solution and no water was used, therefore 0.6 per cent, in the second tube 58 drops of salt solution and 2 drops of water, therefore 0.58 per cent, in the third tube 56 drops salt solution and 4 drops water, therefore 0.56 per cent, and so on until 0.3 per cent was reached. To facilitate matters one-half of these quantities were used. To each test tube one drop of the washed red corpuscles was added. The tubes were allowed to stand at room temperature for two hours, at which time the reading could be made, or later if desired.

FRAGILITY TEST, CASE 1, SPLENECTOMY

	Hæmolysis Begins	Complete
March 25, 1915	50	38
March 27, 1915	52	36
April 1, 1915, Acholuric crisis	50	42
April 5, 1915, Adrenalin test, before Adrenalin test, 40 min after utes	50	44
April 7, 1915, Op Blood from Splenic vein	50	44
Blood from Splenic artery	46	40
April 30, 1915 Discharge	50	44
	54	40

FRAGILITY TEST, ALL CASES EXAMINED

	Hæmolysis Begins	Complete
A M B (father), first family	52	40
P R B (son), first family	50	36
R B A (daughter), first family	50	38
C H (mother), second family	50	32
Ch. H. (son), second family	52	
R H (daughter), second family	46	28
C H (daughter), second family	48	28
C L W (non familial)	54	32

ARTERY-VEIN FRAGILITY IN DOGS

	Hæmolysis Begins	Complete
Dog 1 Splenic artery	52	36
Splenic vein	54	36
Dog 2 Splenic artery	48	32
Splenic vein	46	32
Femoral artery	50	32
Femoral vein	50	32
Dog 3 Splenic vein	46	32
Femoral artery	44	30
Femoral vein	44	30
Dog 4 Splenic artery	46	32
Splenic vein	47	32
Femoral vein	44	32

At the operation of Case 1 blood was obtained from both the splenic artery and splenic vein. The fragility of the arterial blood was found to be higher than that from the vein, i.e., hæmolysis began at 0.5 per cent and 0.46 per cent respectively. Graf had found no difference in a similar experiment. We then tried similar experiments upon dogs, and while a difference was usually detected yet it was not constant, and no conclusions can be drawn.

That the fragility is not constantly increased in all cases of hæmolytic jaundice has been observed. It was not materially

increased in two individuals of the second family here reported; one of these had had well-defined crises, but both were in good health when examined. It is quite likely that the fragility changes from time to time, as has been described, and it may persist a long time after splenectomy. An increased fragility may be present in other conditions, but is unusual. We found a high fragility in a case of nephritis with much anæmia, i.e., hæmolysis beginning at 0.50 per cent and complete at 0.32 per cent.

In obstructive jaundice, pernicious anæmia, and splenic anæmia the resistance of the red cells (lowered fragility) is increased, which is not only an aid to diagnosis but also serves to point out certain cases which appear under the clinical picture of pernicious anæmia and Banti's disease.

PATHOGENESIS

It is generally considered that the hæmoglobin molecule is split in the circulating blood or spleen into two fractions, the first, the iron-containing (hæmatin) fraction, is conserved in the liver (Kupffer cells), bone-marrow, and other parenchymatous organs, and the second, the pigment-containing fraction, is excreted by the liver as bilirubin. The bilirubin being converted into urobilinogen in the intestine is absorbed and excreted as such by the kidneys.

Just what the pathogenesis of this disease may be is not definitely known at the present time. Recent operative results set aside all former theories (hepatogenous) which do not ascribe to the spleen the principal etiological rôle. It is safe to say that if the spleen is not the sole cause it is at least an essential factor in the pathogenesis of this disease. The old theories of liver origin must be discarded, but there seems no question but that the liver plays an important part in the disease process.

Chauffard and Vidal consider hæmolytic icterus essentially a blood disease, the splenic tumor spodogenous, and the decreased osmotic resistance (increased fragility) of the red cells the essential factor.

Eppinger considers altered splenic function the essential etiologic factor speaking of it as

42 and 43	Fischer Wien Wochenschr 1913, No 26 1627	reports 9 splenectomies with good result normal	In one case the splenectomy was performed in 6 days. In one case after 1 year the blood picture was nearly normal.
44 and 45	Kuschitz Hamburg Wochenschr f Chir 1914, 1 225	reports 9 splenectomies but these did not continue	The second case a girl of 13 had epidemic attacks 3 days after operation.
46	Isakel Lund Wochenschr f Chir 1914, 1 225	reports one operation with recovery	
47	v. Haberer	is quoted by Mühsam (Deutsche med Wochenschr 1914, No 8, 377) as having reported 25 splenectomies for hæmolytic jaundice	
48	Author's case see body of article		

"hypersplenism," in comparison with diseased processes of other ductless glands

An increase in the unsaturated fatty acids in the blood (Eppinger, King) may be of etiological importance, and the fact that the bile has much to do with normal fat digestion must be cited in support of this theory, the process possibly being a perversion of some normal function

Whether the hæmolytic agent resides in the spleen or in the general circulation is not known, but it is fair to assume that abnormal hæmolysis is active at all times, and that there are periods of massive hæmolytic activity (acholuric crises). Eppinger estimated the amount of blood destruction as being enormous during the severe crises. He assumed that one molecule of urobilin excreted represents a molecule of destroyed hæmoglobin, and in this way came to the conclusion that during one of the severe crises as much as the total blood supply at any one time may be destroyed, which must be a tremendous drain upon the blood-making organs, which when exhausted produces the blood picture of pernicious anæmia

DISCUSSION OF RESULTS OF SPLENECTOMY

The first splenectomy for hæmolytic jaundice was reported in 1912 by Banti, the operation having been performed in 1903. Micheli published his case shortly after Banti. Before the picture was recognized earlier operations had been performed in cases which are now known to be hæmolytic jaundice, as, for instance, Sir Spencer Wells in 1887, Bland-Sutton in 1895, Vaquez in 1907. Mühsam, in 1914, stated that to his knowledge the operation had been performed fourteen times with surprisingly favorable results. Thursfield and Gow in 1914, collected and tabulated 22 cases, of which 12 were congenital (2 doubtful cases) and 10 were acquired forms. In the accompanying table we present 47 cases collected from the literature. These with our own given in detail, make 48 cases available for study. Of these 16 were of the acquired type, 23 familial, and 9 were unclassified.

The symptomatology and results in these cases in which the diagnosis has been confirmed by operation serve to crystallize our knowledge of the clinical picture and em-

phasize certain points in the pathology and therapy. While the literature of the cases unoperated upon has been consulted, the accompanying remarks are based upon the results shown in the table attached, including only splenectomized cases.

The symptoms in the congenital or familial type differ in no way from those found in the acquired type, except that the latter would seem to progress somewhat more rapidly and more frequently to severe acholuric crises. This is emphasized when we note that in 10 out of 15 cases of acquired jaundice the duration of the jaundice had been short—in fact, less than four years. In regard to the familial type, it was frequently noted that the children in an affected family seemed to suffer more severely than the parent, and they showed a greater tendency to severe crises and the development of complications.

The disease may appear in variable intensity in various members of the family through several generations, and in the great majority of cases is of such a mild character that the patients may live to old age and demand no therapy. In these the condition might pass unnoticed were it not for the icteric tinge to the skin. In certain individuals, however, the process is so marked as to give rise to the typical picture demanding treatment. This may be described as a chronic, mild icterus, with or without indefinite weakness and malaise, upon which are engrafted from time to time the so-called "crises," consisting of marked increase in size and tenderness of the spleen, with malaise, headache, and slight fever, accompanied by an intense hæmolytic, sometimes with hæmoglobinæmia at the height of a crisis, as in our case, with anæmia, urobilinuria, bile pigment in the blood but not in the urine and a deepening of the acholuric jaundice—in this differing from the ordinary jaundice in that it is non-toxic, with no pruritis, no petechia, no bradycardia, and is of a light lemon color, the liver is slightly enlarged and tender and may present the liver crises produced by the passage of the thickened bile or pigment stones through the ducts, giving the typical signs of gall stone disease. Unless this complication occurs the stools are of normal color

In our case a duodenal tube was in place during a crisis and the bile content was increased, the duodenal juice being a dark mahogany brown. An examination of the blood will show an increased fragility.

The amount of anæmia depends upon the efficiency of the hæmopoietic system, which, when exhausted, gives the blood picture of pernicious anæmia. One can always find evidence of excessive regeneration, i.e., polychromatophilia, nucleated reds and certain reticulated bodies in the red cells stained by vital stains, as first described by Vaughan.

During the so-called crises the spleen increases in size and becomes somewhat tender. The spleens removed at operations averaged over 1,000 gms in weight, one exceptional spleen being reported as 4,500 gms. In 7 only of the 28 cases in which this finding was noted was the spleen under 950 gms. At operation evidences of perisplenitis were present, with adhesions in 8 cases. The age of onset, as noted in 13 of the acquired cases, was most often in the neighborhood of the third decennium. None was seen under sixteen and 3 occurred later in life, at thirty-nine, fifty-one, and fifty-two respectively. In all of these cases, however, owing to the lack of evident symptoms the disease may have been present previously. While most of the familial cases are noted as having had jaundice in infancy, some did not show this until later, or they were described as being "anæmic."

The anæmia in cases coming to operation varied widely, a few having as low as a million red blood cells and some slightly less than normal but the majority showed from two and one half to four millions, with a color index of one in nearly every case. The white cells were normal in number except in 2 cases, where they were below normal, and one extraordinary case, where they reached two hundred thousand. In this patient they reached ten thousand four weeks after operation. Sporadic leucocytosis was seen in many cases at the time of liver crises. In our patient it ran as high as thirty-eight thousand.

In practically every case where the urine was examined, urobilin or urobilinogen was

found, and there were no bile salts except in those cases where the patient was suffering from gall-bladder complications. Bile salts were noted in the blood in some instances. The pains in the abdomen were referred to the splenic region and in a few cases to the liver also. Slight enlargement of the liver was noted in 9 and great enlargement in 2 cases, although such enlargement cannot be said to be a conspicuous sign. There is also no distinct tendency to hæmorrhages of any type, although epistaxis was noted in 4 patients, bleeding of the gums in one, and hæmatemesis in another. The frequency of acholuric crises varied greatly, in the more severe cases appearing every three to four weeks and in the milder cases infrequently.

The most frequent complication met with was the so called liver crisis, due to the passage of thickened and excessive bile or of gall-stones. In 4 cases gall-stones were removed, one of these being in the common duct. In 2 cases an exploration of the gall-bladder was performed with negative findings.

PATHOLOGY

The findings in the spleens removed showed very little, if any, proliferation of connective tissue. There was frequently a high-grade loss in the follicles and no germinal centers, while the spleen sinuses were dilated at times, constant infiltration of the pulp was more typical, the endothelium was proliferated and filled with coarsely granular hæmosiderin, which was also found in the reticulum about the blood-vessels. The red cells were less sharply outlined and stained less clearly than normal.

The autopsies show little change in the liver, except for the deposit of pigment, partly with iron and partly iron free. This also is seen in the kidneys and bone marrow. The latter also shows the picture of great overaction.

TREATMENT

In many cases the course is so mild as not to call for treatment, and in the more severe cases many years may elapse before the severe crises or complications bring the patient to the physician. The use of iron, arsenic, and other drugs has not served to

alter or ameliorate the condition, and X-ray therapy has been tried without result. On the other hand, the remarkable benefit secured by splenectomy, as shown by the accompanying collection of cases, would seem to recommend this procedure, not alone in these severe cases, but also in the milder but progressive types, to forestall the onset of complications on the part of the gall-bladder and relieve those patients who are constantly more or less ill but who do not, as yet, suffer from severe crises. This would seem to be indicated particularly in the younger individuals, where we should not wait for the large splenic tumor or marked general disability which would prevent the proper development of the child. On the other hand, we would not be considered as advising the procedure in the absence of some disability, since a larger proportion of these cases apparently grow to old age without any subjective evidence of illness. Where feasible it is advisable to operate in the free interval between the crises. In our case we administered 10 ms of adrenalin, 1:1,000, hypodermatically a half-hour before operating, to reduce the size of the spleen. This produced a contraction of at least two inches in the diameter and restored to the circulation that bulk of blood. This certainly was of some benefit, if we assume that it did not at the same time force out toxins from the spleen — and in our case we were able to say that if this occurred it did not produce a marked increase in the hæmolysis.

TECHNIQUE

This is not the place to discuss the technique of splenectomy in general. We may say, however, that the left rectus incision prolonged well up into the costosternal notch gives good access to the field of operation. The dislocation of the spleen is materially aided if the back is raised and bent upward by the kidney elevator or sand bags. The adhesions which are frequently present should be separated gently. In the case here described, the adhesions were very firm, and it was found that if the capsule of the spleen was detached gently with a sponge, so as not to tear the spleen pulp, the resulting oozing

from the denuded spleen could be controlled easily by a laparotomy pad and the detached adhesion caught by long, curved forceps. In case the bleeding is severe, picking may be resorted to and the operation completed at a subsequent period. After the spleen has been dislocated from the abdominal cavity, which should be the first procedure, the pedicle should be clamped with double forceps, the proximal being haemostatic with rubber-covered blades and the distal crushing, and the spleen cut away as far distal to the crushing forceps as possible. Heavy ligature material should be used and the pedicle ligated either in sections or by a figure-of-eight, so that there is no possibility of slipping. In case of doubt, the artery can be isolated easily and ligated separately. Before the final tying of the pedicle the haemostatic forceps should be slowly loosened so as to secure the stump more firmly. Care should be taken to separate the tail of the pancreas from the pedicle, although in some cases it may be used intentionally to make a more secure ligation of the stump. It has been suggested that the post-operative rise in temperature frequently noted in splenectomy may be due to the inadvertent inclusion of the tail of the pancreas in the pedicle, but in the case here reported care was taken to isolate the pancreas, and this unexplained transient temperature occurred on the second and third days.

Care should be taken always to examine the gall-bladder during the operation because of the frequency of complicating gall-stones.

The left sided shoulder pain noted after operation is due to diaphragmatic trauma. This has been particularly brought out by Capps in his study of reflex pain from various types of pleurisy.

PROGNOSIS

Of the 48 cases here collected only 2 died, one shortly after operation, and the other in six weeks, from sepsis, a surprisingly good result when one considers the serious condition of some of the patients. As for the ultimate results, the 46 patients who recovered are reported as "cured"; that is to say, they were relieved of their jaundice and

crises. It is true that in most cases the short time that has elapsed between the operation and the report precluded final statement, yet among the reports are those of Dawson, reporting on the case of Sir Spencer Wells, operated upon twenty-seven years previously; Bland-Sutton's case, after ten years; Banti's, after eleven years, Roth's, after six years, while in 9 cases the patients had been observed over six months after the operation.

The effect upon the blood picture was immediate. In some cases reports are made at various stages, and in other cases only once, which will explain any apparent discrepancy in the following figures: In 7 cases reported in the first two weeks 4 gained from one to two million reds; in 8 cases reported in the third and fourth weeks 3 gained over a million, 2 over two million, and 1 over three million; in 9 cases reported in from three to six months 5 gained a million, 4 three million, and 1 five million; and, finally, of 10 reported after six months 1 gained one million, 5 two million, and 4 three million, leaving one that had not gained appreciably, but the blood count here showed four and a half million. These increases in every case brought the blood approximately to normal; in 22 cases it was above four million, and of these, in 17 above four and a half million, and, in 3, six million or over. The hemoglobin followed the rise in the number of reds. The white blood count was normal unless there were complications.

The effect upon the fragility of the red blood-cells was less conspicuous. The fragility was increased before operation in every case, varying from 0.50 to 0.70. One case is mentioned as becoming normal in five weeks, but for the most part little change was noted before three months, when several are mentioned as being nearly normal. On the other hand, Sir Spencer Wells' case showed a high fragility twenty-seven years after operation, and Roth's after three and one half years, so it is evident that while one frequently will have a decrease, yet a normal fragility is possibly the exception, rather than the rule, after splenectomy in these cases.

The jaundice decreased in most cases in the

first few days, and in nearly all instances was absent at the end of two weeks, while the acholuric crises, with the attendant *malaise*, headache, and fever, ceased entirely. While too few observations have been made over long enough time to estimate the effect upon the gall-bladder complications, it is not unreasonable, however, to assume that the tendency to these would be decreased or removed.

The authors wish to express their deep obligation to Dr Walter H. Nadler for his painstaking collection of cases from the literature herewith presented, to Dr Charles H. Horner for making the fragility tests, to Professor A. I. Kendall for the bacteriological work, and to Professor J. P. Simonds for the histological and chemical studies in the laboratories of the Northwestern University Medical School.

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BLOOD TRANSFUSION BY THE CITRATE METHOD

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IN a preliminary communication¹ I reported on a new method of performing blood transfusion with the aid of sodium citrate. This short report dealt mainly with the results of animal experiments. Since that time I have applied the citrate method in twenty-two blood transfusions on eighteen patients. I have thus been able to

collect in a comparatively short time (about two months), partly with the kind aid of the staff of Mount Sinai Hospital, a sufficient number of cases to test the clinical value of this new and very simple method of blood transfusion. The object of this paper is to describe these clinical experiences, in the hope that the profession may be induced to give this method a trial on a larger scale and

¹ Med Rec 1915 Jan 23

form their own opinions as to its clinical value

HISTORY

The current idea, that transfusion of blood for therapeutic purposes dates back only a few decades, is an erroneous one. In fact, the history of blood transfusion (quoted from Amstel¹) takes us back as far as 1667, when Denis conceived the idea of blood transfer and used it successfully on the human being. The first one to make use of blood transfusion on a larger scale was Blundell, who reported four cases; two of these ended fatally, but the other two were successful. The largest amount of blood used in these cases was 480 cubic centimeters. It is interesting to note that the use of blood transfusion in puerperal fever dates back as far as 1829, although it has recently been again suggested by different authors. It would go far beyond the scope of this paper to give a detailed review of the extensive work in this field in the nineteenth century, although it is a most interesting study. Transfusion was used over fifty years ago in carbon monoxide poisoning, eclampsia, leukæmia, etc. Toward the end of the last century it was gradually abandoned in favor of saline infusion. It is only since Carrel's masterful work in blood-vessel surgery that transfusion was taken up again on a large scale, especially in this country. The reason that Carrel's work was such a great step forward is that his method afforded for the first time a safe way of transferring blood from donor to recipient without the risks and dangers of coagulation. The artery-to-vein anastomosis was for a great many years the method of choice in blood transfusions. Its great technical difficulties were obviated to some extent by the use of certain cannulas (Crile, Elsberg, etc.). Later vein-to-vein anastomosis for transfusion was substituted as a more simple and quite as satisfactory a method as artery-to-vein anastomosis.

The greatest objection to the method of direct transfusion, as the anastomosis method is usually called, is not its minute and rather cumbersome technique, but the impossibility of ascertaining the exact amount of the trans-

fused blood. It is obvious that this is a serious objection. That is one of the reasons why in such a short time the syringe method of Lindeman² became so popular that it practically did away with all the different direct methods. It might be of historical interest to state here that practically this same method was used by Ziemssen³ about twenty years ago. It never became popular, however, and was almost forgotten, until Lindeman revived it. There can be no doubt that the syringe method gives excellent results in the hands of experts. It is not a method, however, which can be used by any physician, or for that matter any surgeon, without strict observance of a great many technical details. The syringe method requires for its proper execution three or four people, who must work together with great precision. Furthermore, the method is an expensive one. The usual set consists of twelve twenty-cubic-centimeter record syringes; and if not handled very carefully they break easily, especially during the process of boiling.

The best proof that the method is not an ideal one lies in the fact that since Lindeman's publication several other methods have been devised which modify it. Modifications always tend to show that the original method is not perfect, for nobody will try to improve upon a method which is perfectly satisfactory in everybody's hands. Unger⁴ has lately constructed a very ingenious apparatus, which is an improvement on Lindeman's technique. Its essential feature is that the aspiration and injection of the blood is regulated by a double-way stop-cock. In this manner the team-work between the two men working on the donor's arm and the recipient's arm respectively is replaced by a piece of machinery and the prompt working of aspiration and injection of the blood is assured.

Kimpton⁵ advised the use of large paraffin-coated glass cylinders (150 to 250 ccm.), after the collection of the blood the cylinder is attached to the recipient's vein and the blood injected with the aid of rubber bulb.

¹ Lindeman. *Med Rec* 1913 979 *Am. J. Dis. Child.* 1913 28

² Ziemssen. *München med. Wochenschr.* 1894, 21 347

³ Unger. *J. Am. M. Ass.* 1913 109 581

⁴ Kimpton. *Boston M. & S. J.* 1913 114 783

⁵ Floor von Amstel. *Bumm's Wien Klin.* 1904.

Satterlee and Hooker¹ used weak solutions of hirudin, to rinse out their cannulas and glass cylinders, minimizing the danger of coagulation of the blood during transfer.

The fundamental difference between all methods of transfusion heretofore suggested and the citrate method which shall be described in detail in this paper is based on the following considerations: All the older methods consider the coagulation time of the blood, which normally occurs in about five minutes after the blood has left the vessels, as a *noli me tangere*. They all tried to adapt their methods to this well-known fact. That is the reason why the vessel anastomosis met with success. The adaptation of endothelium to endothelium is, as we all know, a safe way of preventing coagulation. The danger of coagulation makes the use of a set of small syringes (20 ccm) imperative for the syringe method, instead of one or two large syringes (200 to 300 ccm), and thus complicates the method materially.

Any transfusion, in which the normal coagulation time of the blood is considered as an unalterable factor, is apt to be difficult and apt to require a great deal of personal experience and skill. Must we accept this coagulation time as an unchangeable law? Might it not be possible to inhibit the danger of the clotting of the blood during its transfer without diminishing the clinical value of the transferred blood for the recipient? This was the problem to be worked out and it seemed to me that this problem would be worth a thorough and careful investigation. If solved, blood transfusion, which so far has given only good results in the hands of a limited number, would be changed from a very complicated and difficult method to one of greatest simplicity. Special clinical skill and experience for this work would not longer be required, no haste would be necessary in the performance of transfusion, in short, blood transfusion would be technically as easy as an ordinary saline infusion.

EXPERIMENTS

The problem, then, was to find a chemical substance which would retard the coagulation

of the blood for at least thirty minutes, so as to guarantee a safe transfer of the blood without any haste. Furthermore this substance had to be conditionally atoxic, so that large transfusions of blood (up to 1500 ccm) could be performed with perfect safety.

Several anticoagulating substances are well known in physiological chemistry and have been used extensively in the laboratories: hirudin (leech extract), sodium citrate, sodium oxalate, peptone, glucose, etc.

My work was commenced by testing hirudin. Hirudin has been used quite extensively in Germany in the treatment of eclampsia. Engelmann² reported 14 cases, in which he used up to 0.3 grams of hirudin intravenously without any toxic symptoms. We know from the work of Friedrich³ that 0.1 gram of hirudin prevents 750 ccm of blood from coagulating. From a series of experiments on blood received from patients, where a phlebotomy was indicated, it became apparent that the smallest dose of hirudin applicable for our purpose was 0.03 grams of hirudin to 200 cubic centimeters of blood. For the average transfusion of 1000 cubic centimeters we would then use 0.15 grams of hirudin, only half of the dose injected by Engelmann in eclampsia. Preliminary to using hirudin on the human being, I injected up to 0.1 gram of hirudin intravenously into some medium-sized dogs. One dog died four hours after the injection, but we thought this might be due to an overfilling of the circulatory system, as we had diluted 0.1 gram of hirudin with 100 cubic centimeters of saline solution. The other dogs (0.1 gram of hirudin diluted in 20 cubic centimeters of solution) showed no ill effects (after having been observed five days). I then used hirudin on a patient who had an inoperable carcinoma of the stomach (exploratory laparotomy). As she needed a saline infusion the day following the operation I added 0.1 gram of hirudin (Sachsse) to 500 ccm of saline solution. The symptoms following this infusion were most alarming, cyanosis and precordial pain set in immediately followed by a severe chill. Her pulse became

¹ Satterlee and Hooker. Arch Int Med 1914 1:1 31.

² Engelmann. Zeitschr f Geburtsh u Gynäk 1911 (Nov.).

³ Friedrich. Arch f exper Path u Pharmacol vol xlii.

almost imperceptible, she was in a precarious condition for over thirty-six hours and recovered only very slowly from this severe reaction.

This experience naturally ended further trials with hirudin. Engelmann's reports might induce other investigators to use comparatively large doses of hirudin for different diseases, and it is just this possibility which has induced me, although the results were negative, to embody in my paper these tests with hirudin as a warning against its use.

After the failure of my experiments with hirudin I took up experiments with sodium citrate to test its possible usefulness for our purpose. When I began my experiments with the citrate method I looked over the current literature, but was unable to find any reference to any work done along these lines. After my work had come to a successful conclusion I found that a paper published by Hustin¹ in May, 1914, had escaped my notice. It appears from this paper that the priority, not only for taking up this problem in a series of animal experiments, but in applying it successfully in a case of human blood transfusion, belongs to Hustin, though his method, as we shall see later, limited its usefulness to small transfusions.

Again, as in my experiments with hirudin, the first series of investigations was carried out with the object of finding the smallest dose of sodium citrate required to keep the blood from clotting for thirty minutes. We² took ten test tubes containing 0.1, 0.2, 0.3, etc., up to one cubic centimeter of a 10 per cent solution of sodium citrate. A dog was narcotized and 10 cubic centimeters of blood, taken from his jugular vein, poured into each of the test tubes; another test tube, not containing any citrate, was filled with 10 ccm of blood. The blood in the first test tube, containing 0.01 sodium citrate to 10 ccm of blood, clotted just as quickly as the blood in the control, namely, in about five minutes. The blood in the next tube (0.2 per cent) did not clot for two days. On the third day this tube, as well as the next one (0.3 per cent), showed a soft clot, whereas the rest of them

(0.4, 0.5 per cent, etc.) were still fluid. These experiments were repeated at different times, always with the same results. The interesting fact elicited from these experiments was that sodium citrate mixed at the rate of 0.1 per cent does not change the coagulation time of the blood, but that a mixture of the sodium citrate with blood at the ratio of 0.2 per cent prevents the blood in the test tubes from clotting for three days. The quantity of citrate needed for this object lies just below 0.15 per cent, but in order to be on the safe side it seems advisable to fix the ratio needed for our purpose as 0.2 per cent. Exactly the same rulings were proved to hold good for human blood.

The next question to be answered was in reference to the toxicity of sodium citrate. If the citrate method was to compete with the older transfusion methods, it had to be applicable to transfusions as large as 1,500 ccm. It was not sufficient to prove that small quantities of blood (that is 200 ccm) could be transfused with this method without risk to the patient. I am sure that hirudin would have answered the problem if we had expected to transfuse only small quantities. In a great many cases, however—in fact, in the great majority of blood transfusions—it is necessary to transfuse 700 to 1,000 cubic centimeters and sometimes more. The whole method would have only a limited field of usefulness, if we could not use it for large transfusions with perfect safety to the patient.

Sodium citrate can be used with perfect safety at the ratio of 0.2 per cent. Three hundred cubic centimeters of blood were removed from a dog's carotid artery, mixed with sodium citrate (0.06 gram) and re-injected into the jugular vein of the same dog. No ill effect was noticed during the observation time (two weeks). This experiment was repeated a few times with exactly the same result.

On the other hand, sodium citrate is only conditionally atoxic, which means that we cannot inject any unlimited quantity of sodium citrate into the vascular system without running a great risk. This is proved by the following experiments, which differed

¹Hustin. *Ann. et Bull. Soc. Roy. de Soc. Med. et Nat., Bruxelles*, 1914, No. 4, 104.

²Dr. George Baehr very ably assisted me in these experiments.

from those just described only in so far as the dose of citrate was increased. I took a dog weighing 11 pounds and mixed the blood with 15 ccm of a 10 per cent solution of sodium citrate. The dog died almost instantaneously. This experiment was repeated twice with exactly the same fatal result. It follows that we have to consider 1.5 grams of sodium citrate as a fatal dose for a dog weighing eleven pounds. Fifteen grams would then be a fatal dose for a patient weighing one hundred and ten pounds. As even 10 grams would nearly reach the fatal limit, it would be utterly impossible to apply this method, if the 1 per cent ratio, as suggested by Weil,¹ would really present the smallest dose of sodium citrate necessary for our purpose. The whole method would then be applicable only for small transfusions (Weil has injected 250 ccm of blood mixed with 2.5 grams of sodium citrate), and would thus have a rather limited field of usefulness. Hustin also thought, that 0.2 per cent was too small a dose to keep the blood from clotting, and therefore mixed the citrated blood with the same amount of saline solution, adding some glucose, which is a well known means of retarding coagulation. Here again the adding of an equal amount of saline solution to a given quantity of blood would limit its application to small transfusions (Hustin transfused only 150 ccm in the one case referred to above); it would not be practical from a clinical standpoint to add 1,000 ccm of saline solution to a blood transfusion of 1,000 ccm.

The third point of interest, in addition to the questions of dose and toxicity, is the question of the coagulation time of the recipient's blood after the transfusion. We have seen that blood mixed with 0.2 per cent sodium citrate does not clot outside the body in two to three days. If this fact would hold good after the injection of the citrated blood into the recipient, the older, though more complicated methods, would have clinically such an advantage over this method that this paper need not have been written. However, confirming a statement made by Weil at the

New York Academy of Medicine, animal experiments and experiences in human blood transfusions show, the most interesting fact, that the same citrated blood which does not coagulate outside the body in two days, does not retard the coagulation of the general blood volume. On the contrary, the coagulation seems to be temporarily hastened. Three hundred cubic centimeters of blood were taken from a dog, mixed with citrate (0.2 per cent) and reinjected. The time for the coagulation of the normal blood taken before the experiment was started was five minutes. Blood taken from the same dog three minutes after the reinjection of the citrated blood showed that coagulation occurred after only ten seconds. A third test taken three minutes later showed the same result as the second.

This question certainly would lend itself to a further and more detailed investigation. We have not been able to find in our human blood transfusions any marked changes of the coagulation. The marked hastening of the coagulation of the blood, which we found in the dog experiment, does not seem to hold good, at least not to that extent, for human blood. And if it does, it is of such a short duration that it escaped our notice, as most of our coagulation time tests were taken a few hours or the day after the transfusion. There certainly does not exist, however, any marked retarding of the coagulation after a citrate transfusion, a fact which is of the utmost importance for the question of blood transfusion by the citrate method.

TECHNIQUE

Before describing the technique of blood transfusion by the citrate method, I would like to say a few words about the donor, as I consider the proper selection of a suitable donor of the greatest importance. The donor ought to be a strong, husky individual with prominent veins. It is not advisable as a rule to use members of the patient's family, as they are, often, naturally very excited about the condition of the patient and do not stand the loss of blood as well as a professional donor, who offers his blood for a monetary consideration and has no personal interest at stake. I have seen donors who have given

¹ Weil. Discussion N. Y. Acad. Med., December 17, 1914. J. Am. M. Assn., 1915. 1141-1155.

up large quantities of blood for transfusion at short intervals — ten to twelve times inside of twelve months. Though no fixed laws can be laid down, it is advisable to refuse donors who have been repeatedly used. It is needless to say that all the preliminary tests (Wassermann, agglutination, hemolysis, etc.) must be done just as well with the citrate method as with other methods. There is no doubt that the procuring of a donor and the necessary blood tests make transfusion impossible, when needed on the spur of the moment. In exceptional cases (see Case 16) transfusion may be done without the tests, as a rule it is certainly wise to wait for the tests, which can be done in a few hours.

The technique of the citrate method is so simple that it can be dealt with in a few words. The donor is put on a table, a tourniquet applied to the arm, and the vein punctured with a cannula. The blood is received in a sterile graduated glass jar (500 ccm) containing 25 cubic centimeters of a 2 per cent sterile solution of sodium citrate at the bottom. While the blood is running into the glass receptacle, it is well mixed with the citrate solution by means of a glass rod. After 250 cubic centimeters of blood have been taken another 25 cubic centimeters of citrate solution are added. If less than 500 cubic centimeters of blood are taken (i.e., in infants), the amount of citrate solution added to the blood is reduced accordingly. In cases where we expect to take more than 500 cubic centimeters of blood we have another glass container (500 ccm) ready to be used in exactly the same manner. The glass jar containing the blood is then put aside and covered with a towel to safeguard against contamination. I have not found it necessary to immerse it in hot water or surround the jar with an asbestos covering. The blood is then taken either into the recipient's room or the recipient is brought into the operating room. I consider it a great advantage that this method does not require donor and recipient to be in the same room, this lessens the psychical shock of the whole procedure for the patient. In fact the donor's blood may be collected in the laboratory or office and carried to the patient's bedside (Kaliski).

Another very great advantage of the citrate method is that as there is no connection between the donor and recipient the donor is safeguarded against contagion of any disease or infection which the patient may have.

The recipient's vein is then punctured or exposed by a small incision; the cannula is introduced and attached to a salvarsan flask or a glass funnel. It is advisable to fill the rubber tubing connection between flask and cannula with some saline solution, so as to prevent air from getting into the circulation. After the connection is made the blood is poured into the salvarsan apparatus. In order to prevent sudden overloading of the circulation it is advisable (especially in larger transfusions) to stop the flow of blood from time to time by compressing the rubber tubing. After the blood has been injected the cannula is removed and the transfusion is thus ended. The whole procedure can be performed with the greatest ease and without any hurry, because the citrated blood, as we have seen above, can be kept for two or three days in the glass jar without danger of clotting.

It is rather immaterial what size needle we use for the injection of the blood; in children, for instance, we can use a very fine Goldenberg or Schreiber needle. But it is of the greatest importance for the successful application of the citrate method that we use a large size cannula in taking the donor's blood. I have lately punctured the vein with a Kaliski¹ cannula (gauge 11, B. & S.), and thus collected 500 cubic centimeters of blood in less than five minutes. The shape and construction of the needle (Lindeman, Kaliski Unger, etc.) are immaterial so long as one uses one of large caliber. I would like to warn against the use of needles of smaller caliber (for instance, 14 or 16), because if the blood does not shoot out of the vein, and comes out only drop by drop the blood is apt to clot in the glass jar. I suppose that Zingher,² who has lately published a paper, advising a combination of the Lindeman and the citrate method, did not use needles of

¹ Kaliski. *Med. Rec.*, 1915, LXVIII, 482.

² Zingher. *Med. Rec.*, 1915, LXVIII, 440.

sufficiently large caliber. For if we use needles of sufficiently large caliber, we do not need syringes, which only complicate this method, and certainly are not to be considered as an improvement in the technique.

The 2 per cent citrate solution can be sterilized and resterilized without losing its efficiency. I selected a 2 per cent solution because it simplifies the calculation (30 solution to 300 blood). By varying the percentage one can easily reduce the quantity of solution to be added to the blood. It might be just as advisable, for instance, to add 50 ccm. of a 4 per cent solution to 1,000 ccm. of blood. I have had made up sterile glass tubes (like those for saline solution) containing 50 ccm. of the 2 per cent solution ready for immediate use.

RECORD OF CASES

CASE 1. H M, Mount Sinai Hospital. Clinical diagnosis. Inoperable carcinoma of the stomach and secondary anemia. January 4, 1915 Hemoglobin 19 per cent. January 7 Transfusion of 500 ccm of citrated blood Hemoglobin 31 per cent. Polyuria and increased perspiration after the transfusion. Urine macroscopically and microscopically normal. No rise in temperature after transfusion. Hemoglobin went down during the following ten days to 22 per cent. January 19 Discharged.

CASE 2. S H, Mount Sinai Hospital. Diagnosis. Inoperable carcinoma of the stomach, secondary anemia. Hemoglobin before transfusion 26 per cent. January 8 Transfusion of 500 ccm. Hemoglobin after transfusion 36 per cent. January 18 Hemoglobin 33 per cent. Second transfusion of 700 ccm. Hemoglobin after transfusion 41 per cent. January 19 Hemoglobin 44 per cent.

After the first transfusion moderate polyuria. January 8, 1,750 ccm., January 9, 1,350 ccm., January 10, 1,150 ccm. Twenty four hour specimen of urine before second transfusion 1,150 ccm., after second transfusion 1,800 ccm. January 19, 900 ccm. Urine showed no albumin no erythrocytes, no casts. Moderate rise in temperature after both transfusions. Blood picture not changed. January 29 Hemoglobin 58 per cent.

CASE 3. H T, Mount Sinai Hospital. age 43. Diagnosis lymphatic leukemia. January 11 Hemoglobin 20 per cent, erythrocytes 1,050,000. January 12 Transfusion of 500 ccm of citrated blood. Hemoglobin 25 per cent. No polyuria.

Test of coagulation time. Just before the transfusion 10 ccm of blood were taken, this blood showed a soft clot after seven minutes and was firmly clotted after nine minutes. Blood taken from the patient two minutes after transfusion

showed a soft clot in two minutes and a firm clot in four minutes. Blood taken six minutes after transfusion showed a soft clot in two minutes and a firm clot in four minutes.

Coagulation time on the day after the transfusion showed soft clot in eight and one-half minutes, firm clot in eleven minutes. These tests show that the shortening of the coagulation time is only of very brief duration and that on the day after the transfusion conditions are again the same as before.

January 13 Hemoglobin 28 per cent, erythrocytes 1,130,000. January 20 Hemoglobin 24 per cent. Patient then treated with X ray and kept on the roof of the hospital. February 28 Hemoglobin 39 per cent. Patient in very fair condition.

This patient was evidently not benefited by the transfusion, but fresh air and X ray treatment decidedly improved his condition.

CASE 4. B K, age 18, Beth Israel Hospital. Diagnosis. Purpura hemorrhagica. Bleeding from nose, throat, gums, and vagina, starting two years ago and lasting a few months. Was well until two months ago, since then same bleeding condition. No blood in urine and stool. Temperature ranging between normal and 103° F. Injection of defibrinated blood (10 ccm.) three times.

December 24, 1914. Syringe transfusion. Hemoglobin rose from 20 per cent to 60 per cent, erythrocytes increased from 1,600,000 to 2,740,000, bleeding persisted without change.

January 15, 1915 Hemoglobin 30 per cent. Transfusion of 500 ccm of citrated blood. January 16 Hemoglobin 45 per cent. No rise in temperature. Coagulation time nine minutes. Bleeding from vagina somewhat less. January 17 Rather profuse vaginal bleeding. January 25 Hemoglobin 55 per cent, erythrocytes 4,000,000.

Summary. Though the general condition of this patient was improved after the transfusions, neither the syringe nor the citrate transfusions effected any marked change in the purpuric condition. There was some doubt as to whether we were dealing with a case of hemorrhagic or purpura hemorrhagica.

CASE 5. H O, age 5, Mount Sinai Hospital. Diagnosis. Extensive burns. Admitted November 21, 1914. Several plastic operations. On account of the marked anemia transfusion was advised.

January 20 Transfusion of 150 ccm. Hemoglobin raised from 42 per cent to 51 per cent. January 22 Hemoglobin 54 per cent. January 23 Hemoglobin 58 per cent. January 25 Hemoglobin 60 per cent. General condition very much improved. Patient looks entirely changed. February 20 Hemoglobin 46 per cent. Patient had several more plastic operations and general condition ran down again. February 28 Second transfusion of 150 ccm of citrated blood. Hemoglobin after transfusion 72 per cent. Patient had a temperature of 102° F but had had a temperature previously. Coagulation time four minutes. March 1 Coagulation time five minutes. March 10 Hemoglobin 61 per cent.

Summary This patient was markedly improved by the transfusions, more so by the first than by the second one. Before the first transfusion the boy was apathetic, pale, and bedridden, a few days after the transfusion he walked around and played with the other children in the ward.

CASE 6 M C, German Hospital Clinical diagnosis Primary anemia Hemoglobin 18 per cent, patient extremely pale, erythrocytes 1,000,000 January 23 Transfusion of 900 ccm of blood Hemoglobin after transfusion 30 per cent, erythrocytes 2,100,000 January 24 Hemoglobin 36 per cent Temperature January 23, 103°, January 24, 100.8° January 24 Coagulation time three minutes January 26 Hemoglobin 45 per cent

Summary This patient was greatly benefited by the transfusion and left the hospital within four weeks in excellent general condition.

CASE 7 B F, Mount Sinai Hospital Diagnosis Carcinoma of the stomach, Virchow node present Patient had had a Satterlee-Hooker transfusion a few weeks before, followed by a very severe reaction (temperature of 104°, chills, etc.) Hemoglobin 23 per cent January 24 Transfusion of 700 ccm of blood Hemoglobin after transfusion 27 per cent January 25 Hemoglobin 34 per cent No rise in temperature followed this transfusion, no reaction in any way Immediately after the transfusion the supraclavicular lymph node was removed under local anesthesia by Dr Lilienthal Microscopical report Carcinoma January 26 Hemoglobin 39 per cent January 28 Hemoglobin 34 per cent January 29 Patient left the hospital

This case was interesting mainly in so far as when the node was removed immediately after the transfusion, there was very little bleeding. This case and other cases in this series tend to show that one can safely operate immediately after the citrate transfusion, which is in accord with the experimental findings.

CASE 8 F M, Post Graduate Hospital Diagnosis Carcinoma of the esophagus Previous Jauu Beck operation Transfusion advised to put patient in better condition for radical operation

January 26 Transfusion of 500 ccm of blood No rise of temperature Hemoglobin rose from 62 per cent to 65 per cent January 27 Hemoglobin 68 per cent January 28 Hemoglobin 70 per cent, erythrocytes increased from 3,100,000 to 4,320,000 Patient became brighter and mentality was more clear for a week and then became worse again, therefore no radical operation was done February 20: Died

CASE 9 M A, age 19, Lebanon Hospital Diagnosis Peliosis rheumatica Hemoglobin before transfusion 58 per cent January 30 Transfusion of 500 ccm of blood Hemoglobin after

transfusion 73 per cent February 1 Hemoglobin 79 per cent February 2 Hemoglobin 75 per cent Rise in temperature to 101° after transfusion Coagulation time before transfusion 8 minutes, coagulation time five minutes after transfusion seven minutes, coagulation time one day after transfusion seven minutes

Summary The clinical status was not changed by the transfusion. The hemorrhages stopped for about one week after the transfusion, but began again after this short interval. As remissions occurred in all these cases of hemorrhagic diatheses, we are hardly justified in ascribing this interval to the blood transfusion. We have to assume that this case was not materially influenced by the transfusion. It is possible that frequent transfusions might have been better for this boy.

CASE 10 M S, age 22, Roosevelt Hospital Diagnosis Adenocarcinoma of rectum

February 11, Transfusion of 800 ccm of blood Hemoglobin before transfusion 38 per cent, erythrocytes 3,600,000 Hemoglobin after transfusion 50 per cent, erythrocytes 4,300,000 February 12 Hemoglobin 55 per cent February 16 Exploratory operation was done. The tumor was found to be inoperable.

The indication for transfusion preliminary to a major operation seems to be a very good one, especially when the patients are cachectic. They thus have a much better chance to stand a major surgical operation.

CASE 11 L S, age 23, Mount Sinai Hospital Antecedent history of frequent tonsillitis, during the last five months very profuse menstrual periods, no bleeding from uterus between periods; also bleeding from nose and gums, probably some purpuric condition on the basis of chronic tonsillar infection February 12 Transfusion of 300 ccm of citrated blood Hemoglobin before transfusion 10 per cent, after transfusion 30 per cent February 15 Hemoglobin 35 per cent February 16 Menstruation started, quantity not changed by transfusion February 21 Hemoglobin 28 per cent, February 27, 35 per cent, March 1, 41 per cent, March 3, 46 per cent, March 6, 51 per cent March 20 10 ccm of a 10 per cent solution sodium citrate injected intravenously March 22 Again profuse bleeding

Summary Patient's general condition very much improved (open air treatment). The purpuric condition was evidently not influenced by the transfusion, though the hemoglobin continued to rise very markedly after the transfusion (from 30 per cent to 51 per cent). It is interesting to note that two days after the intravenous injection of 10 ccm of a 10 per cent sodium citrate solution the patient had a very profuse menstrual period.

CASE 12 E K, age 3 Mount Sinai Hospital Hemorrhages from intestinal tract, probably ulcer pylon, following a two hours' anesthesia for con-

genital dislocation of hip April, 1914. Six attacks of hæmatemesis (first hæmatemesis one month after operation) August, 1914. Hæmoglobin 12 per cent Transfusion (syringe method by Dr Hyman). Hæmoglobin raised to 48 per cent Patient left the hospital in good condition

Readmitted February 7 Hæmoglobin 28 per cent Profuse hæmorrhages February 15 Transfusion of 200 ccm of citrated blood from father Hæmoglobin after transfusion 33 per cent February 16 Vomited another blood clot February 17 Stools still tarry, strongly positive for blood February 21 Hæmoglobin 12 per cent Transfusion followed by exploratory laparotomy decided upon Another transfusion from father to child was attempted The father, who was a very nervous and rather weak individual, proved to be a very poor donor this time Though a large vein was exposed and a good size needle introduced, the blood ran out very slowly, drop by drop, and partly clotted in the glass jar The venesection was abandoned after 100 ccm had been taken, and we decided to procure a good donor February 22 Transfusion of 450 ccm of citrated blood Immediately after transfusion exploratory laparotomy with negative findings No reaction followed transfusion Hæmoglobin raised from 14 per cent to 37 per cent February 23 Hæmoglobin 50 per cent; February 26, 45 per cent, February 28 28 per cent Bleeding since February 26 March 3 Hæmoglobin 17 per cent Third transfusion, 350 ccm, given by Dr Unger with his apparatus Hæmoglobin raised to 46 per cent Bleeding continued for three days, then stopped March 20 Hæmoglobin 34 per cent Bleeding has stopped Child, though still very anæmic, is improved

Bleeding time February 23, 9 minutes, coagulation time 6 minutes Bleeding time February 28, 17 minutes, coagulation time 5 minutes Bleeding time March 3, 8 minutes, coagulation time 7 minutes Bleeding time March 5, 14 minutes

April 2 Another very profuse hæmorrhage from the stomach, blood in stools, child very anæmic

Summary The child had a syringe transfusion in August, 1914, after which the bleeding stopped. She then gained rapidly in general health and was perfectly well for 6 months when the symptoms recurred. She had two transfusions by the citrate method in February, 1915, which failed to stop the bleeding. As the syringe transfusion (August, 1914) had been of far greater benefit to the child than the two citrate transfusions (February, 1915), it seemed advisable to give the child another transfusion of non citrated blood. But the absence of a good clinical result after the two citrate transfusions was evidently not a fault of the method but was based on the fact that her disease had progressed, for the syringe transfusion (March, 1915) did not improve her general condition very markedly, and was certainly far less beneficial than the syringe transfusion in April, 1914. It is interesting to note the large quantities of blood given

to this little girl without overburdening her circulation

CASE 13 M R, Mount Sinai Hospital Clinical diagnosis Bleeding gastric ulcer, acute profuse hæmorrhage Pulse 140 Hæmoglobin 35 per cent February 19 Transfusion of 800 ccm of blood Hæmoglobin 55 per cent

February 20 Another profuse hæmorrhage Hæmoglobin down to 32 per cent Second transfusion of 800 ccm of blood (preliminary to exploratory laparotomy) Hæmoglobin raised to 53 per cent Laparotomy (Dr Moschcowitz) A thorough examination of stomach and duodenum failed to show evidences of an ulcer Gastroenterostomy and pyloric exclusion

February 22 Hæmoglobin 62 per cent Coagulation time four and one half minutes No rise in temperature above 100.5° after any of the transfusions

February 23 Another alarming hæmorrhage into the stomach. This was stopped after a stomach wash with ice water. From this time on no further bleeding. Perfect recovery

Summary Though the hæmorrhages did not stop after the transfusions, the patient was decidedly benefited by the transfusions and stood the operation very well. It is worthy of note that in this case an extensive operation was done immediately after the transfusion without any untoward symptoms. The bleeding was certainly not more than normal. This patient received 1,600 ccm of citrated blood (representing over 3 grams of sodium citrate) inside of twenty-four hours without showing any reaction.

CASE 14 J S, Mount Sinai Hospital One year ago appendectomy, since then symptoms of pyelophlebitis. General debility, anæmia, sepsis. Temperature ranging between 100° and 103° Hæmoglobin 35 per cent

February 22 Transfusion of 1,000 ccm of blood Hæmoglobin 50 per cent One chill of short duration after the transfusion February 27 Incision of liver abscess (actinomycosis) Dr Brickner March 4 Died

Post mortem examination Multiple actinomycotic abscesses of the liver Perforations into the lung and pericardium

CASE 15 F R, age 30, Mount Sinai Hospital Clinical diagnosis Post-partum sepsis Blood culture positive (streptococcus)

February 23 Transfusion of 250 ccm, vein punctured with Goldenberg needle Hæmoglobin 76 per cent (as before transfusion) February 27 Second transfusion 250 ccm of blood removed from patient and 450 ccm of citrated blood introduced

While patient had shown no reaction after the first transfusion, she had a chill after the second transfusion, the pulse was rapid and poor, requiring stimulation February 28 Patient improved considerably March 4 Went home against advice March 6 Died

This case was a hopeless one. Blood transfusion has been frequently suggested and practiced in cases of general infections. In this case of puerperal sepsis the treatment was of no avail.

CASE 16 J. D., age 26, Fordham Hospital. No family or previous history of bleeding. For three weeks profuse bleeding from rectum, gums, nose. Hemoglobin is so low that it cannot be ascertained. On account of the very poor condition of the patient the usual tests of the donor's blood were dispensed with.

February 28 Transfusion of 500 ccm of citrated blood. Hemoglobin 30 per cent. Practically no reaction, no increase in temperature, no chills, no polyuria. Patient's condition very good for four days (stopped bleeding). Renewed hemorrhages on the fifth day.

March 5 Hemoglobin 25 per cent. March 6 Bleeding from nose and gums. March 7 Hemoglobin 15 per cent.

Another transfusion was advised, but the patient left the hospital against advice.

CASE 17 E. H., Presbyterian Hospital. Carcinoma of the uterus for three years. Transfusion preparatory to operation. Hemoglobin 35 per cent.

March 17 Transfusion of 450 ccm. Hemoglobin 45 per cent. Severe chill and rise of temperature to 103° followed the transfusion, the next day temperature normal. Coagulation time practically normal. March 23 Exploratory laparotomy (Dr Hawkes). Inoperable carcinoma.

Summary. I saw the patient after the operation. The transfusion had certainly improved the general condition very markedly. Whereas she was very pale before the transfusion she now had a very good color and looked much stronger.

CASE 18 L. P., age 19, New York Infirmary. Admitted December 20, 1914. Most profuse bleeding from uterus at menstrual periods only, bleeding lasting from two to three weeks, possibly a purpuric condition.

January 6 Syringe transfusion (by Drs. Kaliski and Ottenberg). Transfusion of 670 ccm of blood. Hemoglobin raised from 18 per cent to 35 per cent and then rose automatically to 65 per cent. Rise in temperature to 104° following the transfusion. The bleeding was not changed by the transfusion and the hemoglobin fell to 17 per cent. March 18 Second transfusion (citrate method) 500 ccm of blood being transfused. Hemoglobin raised to 23 per cent. Temperature rose to 102° after the transfusion, and the patient ran temperatures for ten days, probably due to an infection of the arm at the site of the phlebotomy and to an intercurrent otitis media. March 30 Condition now improving.

Summary. This patient was more benefited in her general condition by the first transfusion than by the second transfusion, though none of the

transfusions changed the metrorrhagia. Possibly the first donor was better suited for this particular patient than the second one.

CONCLUSIONS

I have intentionally given a rather detailed account of the cases in order that the reader may be enabled to form his own opinion concerning the merits of the citrate method. I have embodied in this list only those cases in which the transfusion was performed by me and which I had occasion to follow up after the transfusion. I have not included half a dozen cases done by others of which I have personal knowledge; the results of this new method seem to have been just as satisfactory in the hands of others as in my own. They all seem to welcome the easy and safe way with which transfusion can be performed.

The clinical material of this review of 22 citrate transfusions in 18 cases is comprised of the following cases: Inoperable carcinoma, 3 cases; preoperative transfusions, 3 cases; purpura hemorrhagica and allied conditions, 5 cases; lymphatic leukemia, 1 case; severe anemia, 2 cases; gastric hemorrhage, 2 cases; actinomycosis, 1 case; puerperal sepsis, 1 case. Out of these 18 cases 4 were transfused twice within short intervals.

All the points of clinical interest have been discussed in the records of the cases. However, I would like to dwell on some which are of importance not only in regard to the citrate method but in reference to any human blood transfusion.

Some of the cases showed a rather marked polyuria lasting twenty-four hours, though I must say that this increased excretion of urine appeared only in a small percentage, none of the cases showed any macroscopical or microscopical changes in the urine. A marked rise of temperature was noted in 5 cases, 3 of which were accompanied by a chill after the transfusion. It is possible that some rises in temperature escaped our notice as the patients were running septic temperatures before the transfusions. It is a well known fact that chills following transfusion, or even simple saline infusions, occur rather frequently. (Landeman¹ had 22 chills

¹ Landeman. J. Am. M. Ass. 1914.

in a series of 62 cases) In our series chills were observed in three cases out of twenty-two transfusions

A good indicator of an effective transfusion of blood is the automatic rise of the hæmoglobin after the transfusion. For instance, by a transfusion we raise the hæmoglobin of the patient from 20 per cent to 40 per cent, and we notice during the following week that the hæmoglobin goes up automatically another 10 to 12 per cent This rise of the hæmoglobin was noticed in a large number of our cases and is a proof of the good clinical value of the citrated blood

The question of the coagulation time has been discussed above If the hastening of coagulation after the injection of citrated blood, as apparent from animal experiments and some experiences on the human being, were to last any length of time it would be of the greatest value in different hæmorrhagic conditions (especially hæmophilia) The shortening of the coagulation time is however, of such a transitory nature the clinical conditions existing before the transfusions are re-established so quickly that we cannot expect any greater help for these diseases from the citrate method than from any other method of transfusion

It would be very tempting to enter upon the broad question of the indications calling for blood transfusions This paper however was written mainly to advocate a new method of transfusion and a thorough investigation of these indications would go beyond its scope Furthermore Ottenberg and Libman¹ have taken up this subject in an admirable paper on 'Blood Transfusions Indications Results General Management' which will be published in the near future Their paper based on experiences in 212 cases of blood transfusions dwells upon all the interesting factors of this subject It must be considered as one of the most valuable publications in this field

Transfusion of blood as we have seen

¹Ottenberg and Libman New York Academy of Medicine Transactions 1914

above, had a very varied career in our medical armamentarium. Though practically forgotten for nearly a century, it has been revived in the last decade and on account of great improvements in the technique (uppermost among them the blood tests for agglutination and hæmoly-sis) transfusion is now to be considered a safe method, yielding excellent results in properly selected cases The success of transfusions is most striking in profuse hæmorrhage (ulcer of the stomach and duodenum, ectopic pregnancy, typhoid and cholæmic hæmorrhages, etc.), in different forms of poisoning and in some hæmorrhagic conditions It produces excellent and lasting results in cases of primary and secondary anæmia, whereas improvements following transfusions in different forms of leukaemia and pernicious anæmia are not as a rule of a lasting character I think transfusion ought to be practiced much more than heretofore as a preparatory step in cachectic patients who are to undergo extensive operations Operative shock seems to be a promising field though the experiences of Ottenberg and Libman are not very encouraging Though a great deal has been written on this subject in the last year some of the indications for transfusion in sepsis and tuberculosis are still very questionable If we approach the question of transfusion without too great an optimism on the one hand and without being over-keptical on the other hand we are sure to make progress in this most interesting field Transfusion is not a panacea for every disease but it certainly has a wide field of usefulness

I am well aware that this new method of transfusion has to be tested on a much larger scale before definite judgment can be passed upon it However I think that the reports given above are sufficiently encouraging to induce the profession to give this method a fair trial I feel assured that the citrate method has come to stay Clinically, it appears to be as good as any of the older methods and at the same time it has the advantage of the utmost simplicity

A PLASTIC OPERATION FOR BUYO CHEEK CANCER IN ITS EARLY STAGE AND A FURTHER REPORT OF BUYO CHEEK CANCER CASES

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IN a former paper¹ the writer has rather fully considered the subject of buyo cheek cancer, describing the buyo chew, which consists of a mixture of the buyo leaf, betel nut, lime, and tobacco, as a definite etiological factor in the production of cancer of the cheek, discussing in that paper the symptomatology, pathology and prognosis, and lightly touching on the treatment of buyo cheek cancer.

It is the purpose of this paper to present a plastic operation for early buyo cheek cancer which the writer has employed with satisfactory results, and to report further cases of buyo cheek cancer which have come to the writer's service at the Philippine General Hospital since the last paper was presented.

The pathological lesion which this operation aims to meet is an epithelioma which occurs on the inner aspect of the cheek, where the buyo chew is held, and the regional submaxillary lymphatic glands which may become the seat of metastasis (Fig. 1).

Anatomically the approach to the growth presents some difficulty, as the epithelioma often extends posteriorly to the level of the last tooth. The seventh nerve and preservation of the cosmetic appearance of the face make a radical procedure with happy results a rather complex one.

The exposure of the inner aspect of the cheek must be sufficient to allow the operator to see clearly the field of operation as far posteriorly as the last tooth. The seventh nerve should be avoided to prevent a subsequent facial paralysis. The best future cosmetic appearance after the operation is greatly to be desired, especially in women. Another problem is the covering of the defect of the mucosa and underlying tissue after removal of the growth.

The operation here described meets the pathological condition if the growth is still in

the early stage, before the entire thickness of the cheek is involved, and, anatomically, the important structures are spared and the expression and contour of the face and the cosmetic appearance are but slightly impaired.

The incisions employed in this operation may for convenience of description be divided into three groups. First, a cut is made from the angle of the mouth to the lower border of the ramus of the jaw and extending to the angle. The aim of this is to give access for removal of the growth within the oral cavity and by the same procedure to expose the submaxillary lymphatic glands. A second circular incision is made on the side of the neck to form a flap with pedicle or hinge to cover the defect of mucosa caused by the removal of the growth and thus give an epithelial lining within the oral cavity. The third group of incisions is made lower down on the neck to form flaps to slide up and cover the area denuded by the turning up of the circular flap.

The first incision (Fig. 2, 1-2-3) extends from the angle of the mouth downward and slightly posteriorly to the lower border of the ramus of the jaw, then posteriorly to the angle. The hemorrhage from the labial artery is controlled by placing two curved hemostats on the lip and cutting between them. The entire thickness of the lip and lower cheek is incised down to and along the ramus to the angle of the jaw, sparing however, the facial artery. The cheek is now elevated and everted and the malignant growth well exposed, giving an unobstructed view to the most posterior limits. A circular incision of the growth is now made, care being taken to cut wide of the margin of the epithelioma. The growth and a portion of healthy or uninvolved underlying tissue is excised, leaving a circular defect in the mucosa and underlying tissue of the cheek.

The second incision (Figs. 2 and 3, c-a-b-d)

is circular in shape or cut to correspond to the defect made on the inner aspect of the cheek. This skin-flap is dissected from the underlying tissue except at the line *c-d*, which is left intact and used as a pedicle or hinge. This flap is turned into the mouth, using the portion *c-d* as a hinge, thus bringing the skin surface of the flap toward the oral cavity and the cut surface of flap next to the cut surface of the cheek made by removal of the epithelioma, the line *c-d* now forming the lower portion of the flap and *a-b* the upper border in its new position.

The edges of the skin-flap are now sewed to the edges of the mucous membrane of the cheek, which has been approximated to the upturned flap, and the skin-flap thus forms an epithelial lining for the mouth at the site where the growth was removed. The regional submaxillary lymphatic glands are now readily removed.

The third incision aims to close the defect of skin on the side of the neck caused by the turning up of the circular flap *c-a-b-d*. This is effected by an inverted Y-incision (Fig. 3, *a-e-f* and *b-e-g*). The two flaps *a-e-f* and *b-e-g* are now undermined and slid upward to the original line, 1-2-3, below the ramus of the jaw (Figs. 3 and 4).

Thus operation, of course, is only indicated in early cases when the growth is more or less limited to the mucous surface of the cheek. The result is good. The seventh nerve is not injured, the facial expression is preserved, and but a single line from the angle of the mouth mars the cosmetic appearance of the face. A high collar readily shields the neck scars.

The question of choice of anæsthesia employed in this operation is of importance, as the chance of a subsequent aspiration pneumonia caused by the inhalation of blood, which is of necessity more or less copious, is great with an improperly applied anæsthesia.

The writer has employed whisky, morphine, and ether. One-half hour before the operation one-fourth grain of morphine is given hypodermatically and an ounce of whisky is taken by mouth. The patient is then put well under the ether anæsthesia. When the operation is started the ether anæsthesia is stopped and not used further. The skin in-



Fig. 1. A case of buyo cheek cancer (Series No. 78), showing the growth in its classical site and the blackening of the teeth. This patient is 74 years old and has chewed buyo for 62 years, during which time he always held the chew next to the left cheek in a position corresponding to the site of the present lesion. Photograph by the Bureau of Science. The patient is from the writer's service at the Philippine General Hospital, Manila.

cisions are then made, during which time there is no hemorrhage into the oral cavity.

The patient now partly comes out from under the ether as the operator is excising the growth within the oral cavity, and the patient is able to spit out or reflexly cough up any blood finding its way into the respiratory passages. The patient is able to understand the orders of the operator and will spit out or cough up the blood or hold his head in a convenient position as told, but suffers during this period no sensation of pain. Thus we have a minimum of ether anæsthesia and of aspiration of blood.

Since presenting a paper on "Buyo Cheek Cancer," which was a study of seventy-five cases of oral cancer with special reference to cheek cancer and its etiology, the writer has had four more cases which are reported as follows.

Of the 75 cases of oral cancer previously reported, 49 were in the cheek. With these 4 cases we have a series of 53 cheek cancer cases.

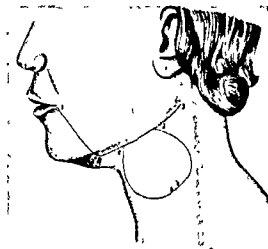


Fig 2 This drawing shows the skin incisions employed in the plastic operation for bucco cheek cancer in its early stage. The incision 1-2-3 is made first. This flap when turned up gives access to the new growth. The plastic flap c-a-b-d is then made. The flap c-a-b-d is to be used to cover the defect in the mucosa and underlying tissue resulting from the excision of the new growth. The portion of the flap c-d is used as a pedicle or hinge when the skin flap is turned up.

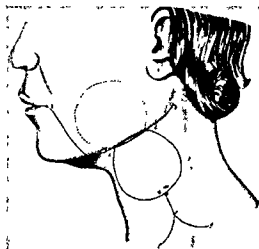


Fig 3 This drawing shows the first incision 1-2-3 made to give access to the growth and the second incision c-a-b-d, the skin of which is undermined and turned back as a flap, using c-d as a pedicle or hinge to cover the defect in the cheek made by removal of the growth and is represented in its new position by the dotted lines and the third incisions a-e-f and b-e-g which are made to form flaps to cover the defect resulting from the turning up of the flap c-a-b-d.

The observations and conclusions made in reporting the former cases are well borne out in the further study of these cases. Here we have a definite history of bucco-chewing extending over a long period varying in this series from 28 to 70 years. The occurrence is in patients of advanced years and the site of the lesion corresponds to the position in which the bucco chew was held.

That the lime is the active agent in the production of these epitheliomata the writer is convinced by a further study of the use of the same lime as is used in the bucco chew in producing the "fuente."

"Fuente" is a Spanish word and literally means "fountain." It is not an uncommon custom among the islanders in cases of chronic open ulcers of tuberculous, luetic, or chronic pyogenic origin, or in leprosy lesions to produce the "fuente." As the ancient Greeks used the seton to allow the escape of evil humors so too the "fuente" is made to form a "fountain" for the escape of pus or as a counter irritant, and thus to exert a kindly influence upon the troublesome lesions.

The "fuente" is produced by the application of lime and soap. A large bucco leaf, in the center of which is a hole, the size corresponding to the desired size of the "fuente," which is generally two or three centimeters, is applied over the portion of the anatomy where the "fuente" is desired. For lesions of the neck and upper extremity the lateral aspect of the upper arm is often selected, and the inner aspect of the thigh is selected in cases where the lesion is in the leg.

The lime and soap in the form of a paste, is applied to the skin through the hole in the bucco leaf which has been placed over the skin. A dressing and bandage is then applied. This is sometimes preceded by a scarification or burning with a cigar tip.

After a few days of constant application of and irritation by the lime and soap the skin becomes ulcerated through its entire thickness and the underlying muscle comes into view. The wound is now kept open by introducing a small round ball of wood which is held in place by a bandage and thus a "fuente" or a continuous discharge of pus results. Thus



Fig 4 This drawing shows the incision 1 2 3 sutured. The flap turned up from the neck into the mouth is represented by the dotted lines, and the pedicle or hinge by the line c-d. The flaps a e f and b e g are slid up to the line 1 2 3 to cover the defect caused by the turning up of the flap c a b-d.

we have an ulcer resulting from a chemical irritant, the lime, quite independent of any mechanical agent.

This point is brought out to emphasize the statement made by the writer in a previous paper that the active agent of the buyo chew which produced the "buyo cheek cancer" was the lime constituent of the chew.

Series No 76, Hospital F No 3325, 1914, age 80, male. Chewed buyo 70 years, lesion on right cheek where buyo was held in mouth. Present illness began one year ago as a small ulcer on the inner aspect of the right cheek near the angle of the mouth. This gradually enlarged and became quite painful, especially when irritated by food. Examination of the localized lesion. An irregular, rough red, tender, slightly elevated growth with raised border is situated on inner aspect of the cheek near the angle of the mouth. This is about 3 cm in diameter. The regional submaxillary lymphatic glands are enlarged and hard. Diagnosis: Epithelioma of the cheek with regional metastasis in submaxillary lymphatic glands.

Series No 77, Hospital F No 3598, 1914, age 40, female. Chewed buyo 28 years, lesion on left cheek where buyo was held in mouth. Present illness. Ten months ago the patient noted a small, round enlargement on buccal mucosa of the left cheek. This gradually enlarged. One week ago this became ulcerated. She suffers slight pain when food touches the growth. Examination of the



Fig 5 Photograph of a patient upon whom this operation was performed. The final arrangement of flaps is same as is diagrammatically represented in Fig 4. Photograph by the Bureau of Science. The patient is from the writer's service at the Philippine General Hospital, Manila.

localized lesion. On buccal mucosa of the left cheek is an ulcerated area, irregular in shape, and about 2 cm in diameter. The edges are clean cut and elevated. There is induration in the surrounding tissue. The submaxillary lymph glands are enlarged and indurated. Diagnosis: Epithelioma of the cheek with regional metastasis in the submaxillary lymphatic glands.

Series No 78, Hospital F No 4211, 1914, age 74, married, male. Chewed buyo 62 years, lesion on left cheek where buyo was held in mouth. The patient began chewing buyo when ten years old. He held the buyo on the left side until the present trouble appeared. Since, he has held the chew on the right side, that is, he held the chew at the site of present lesion for a period of 62 years. (See Fig 1.) Present illness. Began two years ago, when he first noted a small, elevated, white area on the inner aspect of the left cheek, located about the center of the cheek. At first it was not painful, but at present it is. The growth has gradually enlarged. Examination of the localized lesion. On the inner aspect of the posterior half of the left cheek, extending from the center of the cheek to the posterior portion of the cheek and downward,

encroaching upon the mucosa of the lower alveolar process is an elevated irregular, rough, white non-ulcerated growth. The submaxillary lymph glands are enlarged and indurated. Diagnosis Epithelioma of the cheek with regional metastasis in the submaxillary lymphatic glands.

Series No 70 Hospital F 4108 1914, age 80, white, male. Chewed buio 60 years, lesion on left cheek and left lower gum where buio was held in mouth. Present illness. Two months ago the pa-

tient first noted a swelling in the right lower gum which later extended to the adjacent portion of the right cheek. Examination of the localized lesion. All his teeth are gone and at the middle portion of the right gum is an irregular, rough growth which is about two inches long, and encroaches upon the right cheek. The right submaxillary lymphatic glands are enlarged and indurated. Diagnosis Epithelioma of the left cheek and gum, with regional metastasis in the submaxillary lymphatic glands.

PULSION DIVERTICULUM OF THE OESOPHAGUS

A NEW OPERATION FOR ITS CURE

By OTTO C GAUB, M.D., F.A.C.S., AND CHEVALIER JACKSON, M.D., F.A.C.S., PITTSBURGH

AS shown by the case illustrated in Figs 1 and 2, a pulsion diverticulum if not removed increases in size until it becomes a serious menace to the patient's health and even life, by the dysphagia due to the compressive stenosis caused by the sac into which food first enters in each attempt at deglutition. So far as known at present the only treatment worthy of consideration is operative extirpation. This seems when looking at a radiograph such as that reproduced in Fig 2, to be a very easy procedure. It must be remembered, however, that the radiograph is taken with the diverticulum full of food while the operation must necessarily be done with the diverticulum empty. When empty, a small diverticulum has escaped the search of some of the most careful surgeons. Furthermore, the extent of removal must be determined to a nicety for if insufficient, the patient will not be relieved of the symptoms and the diverticulum will recur.¹ On the other hand, if the removal takes more than simply the redundancy a stricture of the oesophagus may leave the patient worse off than before. Obviously it is impossible to bring the oesophagus up into the external wound for inspection and operative manipulation as can be done with the intestine in an abdominal operation. Pulsion diverticula

occur only in patients past middle life. Most cases are decidedly senile and nearly all are more or less weakened from the prolonged mechanical interference with deglutition. More than half the cases present symptoms of chronic bronchitis. All of these factors render patients suffering with pulsion diverticula bad subjects for the prolonged and tedious operation of extirpation as heretofore practised. The herein described method has reduced the duration of the operation more than one-half and has given to the procedure a precision and certainty never before attainable.

Anæsthesia For the extirpation of diverticula insufflation intratracheal ether anæsthesia should always be used because respiration is very likely to be interfered with by traction on the oesophagus during the dissection or in the pulling out of the sac, or respiration may be interfered with by adductor spasm of the vocal cords due to irritation of the recurrent or of the pneumogastric. Moreover, the anaesthetist is far removed from the field of operation.

Technique The external part of the technique does not differ materially from the classical operation. It may be well, however, to remind the surgeon of the following points:

1 The landmark to bear in mind is the cricoid cartilage.

2 A large vertical extent of wound must be maintained and must be kept clean and dry.

¹ In one case of recurrence seen by one of us the recurrence was in the form of two pouches, one on each side of the previous operation which had been done by a very skillful surgeon.



Fig 1 Pulsion diverticulum filled with bismuth mixture in a man aged 46 years (Radiographed by Dr Russell H Boggs)



Fig 2 Same patient as Fig 1, four years later the patient having declined operation. The great increase in size is usual in untreated cases (Radiograph made by Dr George C Johnston)

by careful hæmostasis at all stages of the procedure

3 The cricoid cartilage and the subjacent rings of the trachea must be seen and identified

4 The oesophagus will be discovered posteriorly to the cricoid and trachea as a thin flat fold pressed against the cervical vertebrae

In the new operation, having exposed the oesophagus, the surgeon asks the oesophagoscopist to push out the diverticulum into the external wound. The surgeon seizes the bottom of the pouch with forceps (Fig 3). He then asks the oesophagoscopist to insert the oesophagoscope into the subdiverticular lumen of the oesophagus. The surgeon then amputates the redundancy, being careful not to make undue tension in order to determine with precision the amount of tissue which really constitutes redundancy.

Closure of the wound, dressing, and after-care do not differ after this procedure from that of the usual operation.

The authors have performed this operation upon two patients.

CASE 1 Mrs D, aged 58 years, referred by Dr R W Fisher for increasing difficulty in swallowing solids. Foul breath and a cough were annoying at times. Patient had "ulcerated sore throat" four years before. Swallowing symptoms were of one year's duration. There had been no regurgitation. Examination with the oesophagoscope, without anaesthesia, general or local, showed a small diverticulum anterior to the oesophagus and slightly to the left. Withdrawal of the oesophagoscope revealed the orifice of the subdiverticular oesophagus anteriorly to the right, covered with a fold of mucosa. The ridge between this orifice and the diverticular orifice was cicatricial (Fig 4, D). The subdiverticular orifice was easily entered with the beak of the slanted end oesophagoscope but would not permit the entire end to enter readily. The tube-mouth was carefully used to stretch the cicatricially contracted orifice and to permit the oesophagoscope to enter freely. At oesophagoscopy seventeen days later without anaesthesia the oesophagoscope entered readily without any sign of recurrence of stenosis, but the diverticulum remained, objectively, as well as subjectively, the same as before dilatation of the stricture. Radiography by Dr George C Johnston showed the diverticulum (Fig 6). External operation by the method above outlined, and illustrated in the schema (Fig 3) was

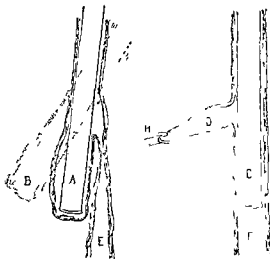


Fig. 3. Schematic representation of the operation. At A the esophagus is represented in the longitudinal section. After the surgeon has cut down to the diverticulum, the esophagus is shown protruding as shown at B. After the surgeon has dissected the diverticulum, the esophagus is shown at H and the esophagus is inserted into the diverticulum. The subdivenicular esophagus is shown at I. The esophagus now occupies the diverticulum and the pouch will need for swallowing. It is shown at J. The pouch is removed by the esophagus without risk of moving any of the normal wall.

done by Dr. Gaub. The esophagus was cut off by Dr. Jackson. The pouch was ligated and transected when the esophagus was withdrawn and each pouch was cut off. The stump externally was ligated. The stump externally was ligated.



Fig. 5. Pulsion diverticulum of the esophagus removed from a man aged 67 years, whose radiograph is shown in Fig. 7 (Case 2).

and supporting sutures were inserted. Feeding was by catheter inserted at esophagoscopy. Firm reunion and prompt recovery followed. One year later the patient was swallowing perfectly.

CASE 2. Mr. S., aged 67 years, was referred by Dr. David Reisman and Dr. Walter J. Freeman of Philadelphia. They had made the diagnosis of diverticulum and had had the radiograph (Fig. 7) made by Dr. H. K. Pancoast. Severe cough, purulent expectoration, and difficulty in swallowing had made the patient's life miserable for the past year. Esophagoscopy by one of us confirmed the diagnosis of Drs. Reisman and Freeman, the findings coinciding with the radiograph of Dr. Pancoast. The subdivenicular orifice (Fig. 4, C) was easily entered with the slanted-end esophagoscope. There were no signs of cicatrices or inflammatory processes. The orifice of the pouch just as the esophagoscopic tube mouth emerged from it, was circular in outline and rolled over at the margin (Fig. 4, B). The operation, as shown in the schematic (Fig. 3), was done by Dr. Gaub, with the esophagoscopic assistance of Dr. Jackson. The pouch after

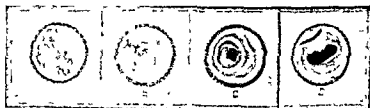


Fig. 4. Esophagoscopy. A, view of the esophagus. B, view of the esophagus. C, view of the esophagus. D, view of the esophagus. E, view of the esophagus. F, view of the esophagus. G, view of the esophagus. H, view of the esophagus. I, view of the esophagus. J, view of the esophagus. K, view of the esophagus. L, view of the esophagus. M, view of the esophagus. N, view of the esophagus. O, view of the esophagus. P, view of the esophagus. Q, view of the esophagus. R, view of the esophagus. S, view of the esophagus. T, view of the esophagus. U, view of the esophagus. V, view of the esophagus. W, view of the esophagus. X, view of the esophagus. Y, view of the esophagus. Z, view of the esophagus.



Fig 6 Radiograph by Dr George C Johnston showing diverticulum in a woman aged 58 years. Diverticulum removed by the Gaub-Jackson method (Case 1)

removal is shown in Fig 5. There was leakage through the neck wound in this case, but healing was complete and swallowing perfect in about four weeks. Almost a year has elapsed and the patient's swallowing is still perfectly normal. Fluoroscopic examination by Dr George C Johnston showed that the bismuth mixture went through the region formerly occupied by the diverticulum without hesitation.

Remarks. This patient was regarded by Dr J H McKelvey before operation as an unfavorable surgical subject because of feebleness, advanced age, impaired vessels, and chronic purulent bronchitis. These conditions fully accounted for a more tardy convalescence than in the first case. This case demonstrated forcibly the great advantages of the expedition afforded by the technical

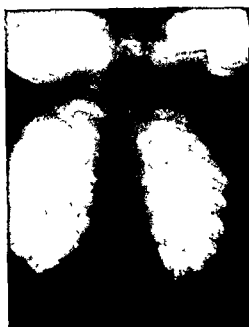


Fig 7 Radiograph showing a diverticulum in a man of 67 years. Diverticulum removed by the Gaub Jackson method. (Plate made by Dr H K Pancoast)

improvement herein advocated. Had the tedious classical operation been done it is questionable if the feeble senile patient would have survived.

CONCLUSIONS

1 If untreated pulsion diverticulum of the esophagus tends strongly to increase in size and in severity of symptoms.

2 Intratracheal insufflation anaesthesia affords advantages in (1) removing the anaesthetist far from the operator's way, (2) avoiding infective risks, (3) insuring safety of respiration and a quiet peaceful anaesthesia in spite of tracheal pressure or glottic spasm from manipulation of the tissues during the surgeon's dissection and amputation.

CYSTS OF THE MESENTERY

WITH A REPORT OF THREE CASES¹

BY EDWARD G. JONES, A.B., M.D., J.A.C.S., ATLANTA, GEORGIA

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THE points of particular interest centering around cysts of the mesentery are their rarity, their genesis, their disputed classification, the infrequency with which they are diagnosed and their rôle in causing intestinal obstruction.

Lawson Tait is said never to have seen a mesenteric cyst, and Spencer Wells² only two. Dr. L. L. McArthur,³ of Chicago, stated in 1912 that he had never seen a chylous cyst of the mesentery, and quotes the late A. H. Ferguson as having had the same experience. In 1912, Friend,⁴ of Chicago, collected 52 cases of the chylous type of these cysts, and in 1913 A. L. Benedict⁵ of Buffalo, supplemented Friend's list, bringing the total up to 96. The chylous type embraces approximately one-half of the mesenteric cysts reported, so that about 200 in all have now been recorded.

Information as to the origin of these cysts is based largely upon a study of the cyst-contents and of the cyst-wall and classifications have been based upon these findings.

An effort to revise their classification in conformity with their origin, and to put them all, except hydatid and malignant cysts, under the head of embryonic growths, was made by Dowd⁶ in 1900. He found in the mesentery of the transverse colon a cyst which corresponded with ovarian cystadenomata in the very material respect of containing pseudomucin and in the further fact that certain secondary cysts growing from its inner wall were lined with epithelial cells. He also found evidence of degenerated epithelium lining parts of the cyst-wall proper. Arguing from these findings he concluded that the cyst originated in a portion of the ovary or germinal epithelium, separated

from the rest of the organ in the early process of development. He showed further that it was at least possible, and to his mind probable, that those cysts which had hitherto been classed as chylous, serous, sanguineous, and lymphatic were in reality all embryonic.

However, those changes in the cyst contents which are developed by time, and particularly those changes in the cyst-wall which are induced by pressure, inflammation, etc., so tend to invalidate the evidence that at one time may have been present in the average mesenteric cyst as to render Dowd's theory at least incapable of anything like uniform proof. Not a few cysts have been found whose origin could be traced with reasonable certainty to a sequestration from the intestine or from the ovary, or to relics of other structures like the omphalomesenteric duct.

The fact, however, that the usual mesenteric cyst is not lined with epithelium at the time of its examination must not be taken as evidence that such a lining did not exist during the early development of the cyst. The gradual or sudden accumulation of fluid within its cavity may have destroyed the epithelial structure, inflammation may have accomplished the same change. Such indeed, we know is the history of parovarian cysts, that is when small they are lined with epithelium, but as they increase in size this epithelium is at first modified and later destroyed.

R. T. Miller⁷ reviews at length the theories as to the origin of mesenteric cysts and records a most interesting case of such a cyst which indisputably represents an intestinal sequestration. He quotes the work of Lewis and Thyng, who in 1908 first observed the actual process of sequestration in the developing gut and whose findings prove that mesenteric cysts undoubtedly may originate

¹ Douglas, *Surgical Diseases of the Abdomen*, p. 731.² *Surg., Gynec. & Obst.* 1912, xv, 1.³ *Ibid.*⁴ *Surg., Gynec. & Obst.* 1913, xvi, 606.⁵ *Ann. Surg.* Phila. xxiii.⁶ *Bull. Johns Hopkins Hosp.* 1913, xxix, October.⁷ Read before the Southern Surgical and Gynecological Association, Asheville, North Carolina, December 1914.



Fig 1 Resected portion of intestine with cyst, Case 1

as intestinal diverticula. Furthermore, there is a very general belief that a certain additional number have their origin in the omphalomesenteric duct.

The following illustrates the progressive changes which have been made in the classification of mesenteric cysts since a large enough number have been studied to warrant classification. In 1897 Moynihan¹ classified them as—

- 1 Serous,
- 2 Chylous,
- 3 Hydatid,
- 4 Blood,
- 5 Dermoid,
- 6 Cystic malignant disease

Only the dermoids suggest an embryonic origin. In 1900 Dowd² proposed—

- 1 Embryonic,
- 2 Hydatid,
- 3 Cystic malignant disease

Here the embryonic origin of nearly all these cysts is implied. In 1907 Niosi³ subdivided the embryonic cysts as follows

- 1 Cysts of intestinal origin—

(a) By sequestration from the bowel during development,

(b) From Meckel's diverticulum

- 2 Dermoids

3 Cysts arising from retroperitoneal organs (germinal epithelium, ovary, wolffian body, mullerian duct)

So that whether or not one agrees with the view that most mesenteric cysts are embryonic, there is evident a growing tendency to believe that a great many do so originate.

It should be said that mesenteric cysts have been variously supposed to originate

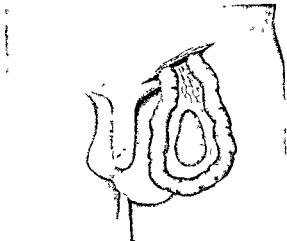


Fig 2 Showing mesenteric cyst found in hernial sac, Case 2

from dilated or ruptured lymph vessels, from degenerating lymph-glands, and from the receptaculum chyli, and such sources can at least not be disproved. There are those (Braquehaye, Moynihan, Porter, and others) who do not at all agree that practically all mesenteric cysts are embryonic and who adhere to those classifications of which Moynihan's is a type.

It is to be regretted that in the cases outlined below there appeared findings of no particular significance as bearing on the subject of genesis. Sections taken from various parts of the cyst walls failed to reveal epithelial lining or other suggestive structure.

It is probable that a diagnosis of a mesenteric cyst is seldom if ever, made prior to operation or autopsy. It would seem, however, that the time has come when such a diagnosis ought to be made in typical instances with reasonable certainty—largely because during the last decade enough cases have found their way into the literature that the surgeon will at least be cognizant of the fact that such a tumor may be in the abdomen and that it should not be overlooked.

Of course, a diagnosis presumes that the cyst has reached some size. If its location be in the mesentery of the small intestine (and not confined to the root of the mesentery) the outstanding feature will be its extreme

¹ Ann Surg Phila, LXVI, 1

² Ann Surg Phila XXXI

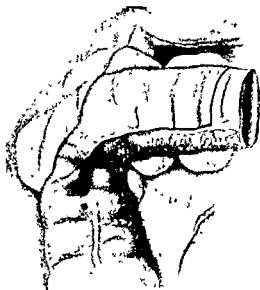


Fig. 1. Showing colon at hepatic flexure with cysts in mesentery. Case 3.

mobility. Theoretically and sometimes actually it can be carried from one side of the abdomen to the other, and can be made to perform similar excursions in a vertical direction. The tumor may at times be rotated on its own axis. Given such a movable tumor, centrally situated fluctuating surrounded by resonance, not connected with the ovary, liver, kidney or spleen, and the diagnosis is practically certain. If there can be added to this information a band of resonance crossing the tumor and a history of recurring attacks of pain and vomiting a positive diagnosis is warranted.

Porter¹ says cysts of the mesentery more often cause pain than do any other cystic abdominal tumors and adds that the same is true of vomiting. These symptoms depend usually upon the encroachment of the cyst upon the lumen of the gut. If the encroachment be moderate, colicky pains due to exaggerated peristalsis proximal to the tumor are apt to occur, if the encroachment be more marked actual obstruction to the fecal current may ensue.

Of prime surgical interest is the possibility of acute intestinal obstruction. Among the types of obstruction, volvulus is prominent. It is possible that in Case 1, reported below, recurring attacks of volvulus had covered three years. In a number of reported cases such recurring attacks were probable, so that such a history assumes considerable diagnostic significance. Porter quotes von Blum as having first called attention to this fact. In Porter's case, acute obstruction occurred from strangulation over a band formed by the cyst pedicle. Further, the stretching of the gut over the cyst has amounted to gangrene (Sutherland). Besides the above types of obstruction there are the usual possibilities of such an accident resulting from adhesive bands between the cyst and neighboring viscera, or following peritonitis (and its consequences) from rupture of the cyst.

These cysts have been treated by aspiration by stitching to the abdominal wall and draining later by enucleation, and by resection of the affected portion of the gut.

Aspiration is no longer justifiable unless indeed it be practiced as a preliminary procedure or for temporary relief when more radical measures would be unsafe. Drainage is not ideal surgery though published statistics indicate that it is not only safer than resection, but that it more frequently cures the patient than one would suppose. These statistics do not however probably represent the relative wisdom of drainage and resection at the present day. Being a simple procedure it is natural that the immediate mortality should be relatively low but the percentage of patients who are not finally cured must enter into a consideration of the comparative merits of drainage and other more ideal measures. Of course when the condition of the patient is critical the simpler procedure is the wiser. In my own Case 1 drainage would probably have been wiser except for the volvulus.

Enucleation is the ideal treatment if it can be done safely.

Resection is, next to enucleation, the treatment of choice unless conditions call for the quickest possible operation.

¹Ann Surg Phila 1911

CASE I Patient, male, age 4, referred by Drs Bell and Tribble, Lithonia, Georgia. Family history Negative. Past history When six or seven months old he had convulsions with some sort of acute abdominal trouble. Convulsions lasted three to six hours, after which the patient gradually recovered from his abdominal symptoms, which were present several days. Every one to six months since the above attack the child has had somewhat similar abdominal seizures, but without convulsions. He always complained of his "stomach hurting," and always vomited. These attacks always came on suddenly, and the severity lasted only one or two hours. Parents do not recall that there was any difficulty about the bowels moving, although they think the abdomen was usually distended during attacks. At the age of two or three years the boy is said to have had typhoid and was in bed one month. This sickness began with vomiting, and throughout the month there was diarrhea. Since the typhoid, the acute abdominal seizures have continued as before. Parents have noticed for two years that the child's abdomen was unusually full above the umbilicus. They cannot recall that the acute attacks commonly followed a jump or fall. Vomiting and purgation have relieved the situation prior to the present attack.

Present illness Four days prior to operation the patient, after jumping from a wagon, was almost immediately seized with abdominal pain and vomiting. This time the pain and vomiting continued, and the family physician, on being called, administered purgatives and enemas without being able to get a bowel movement. These efforts were continued three days when we saw the child. The vomiting had continued meantime without abatement. Physical examination. The child was fairly well nourished. Distention was moderate. The temperature was normal, the pulse 120. On account of the constant crying of the child no very satisfactory physical examination could be made. Visible peristalsis in the upper abdomen was marked. Rectal examination was negative. Diagnosis. The symptoms were those of obstruction without actual strangulation, and a diagnosis of probable intussusception was made.

Operation The abdomen was opened promptly through the right rectus. Immediately there came into view a yellowish mass in the mesentery of the small intestine (Fig 1). The cyst had encroached on the gut so as to greatly restrict its caliber, the intestine indeed being stretched over the cyst like a ribbon and partly buried in it. The whole mass had so fallen over as to twist the gut above into a volvulus. There were no adhesions. The greatest diameter of the cyst (longitudinal axis of the intestine) was perhaps 16 cm., and its transverse diameter about 8 cm.

The cyst encroached so closely upon the gut for such a distance that enucleation was unwise, the integrity of the intestine at the point of volvulus was furthermore doubtful. Resection of the gut

together with the cyst was done. The location was in the mesentery of the ileum, some four feet from the ileocolic junction.

At the close of the operation the child's condition was fair. He reacted indifferently. Within 18 hours he began to have convulsions, his temperature and pulse rose, and he died 30 hours after operation, his bowels meantime having moved two or three times.

Autopsy showed no evidence of leakage around the button and no peritonitis.

Laboratory examination by Dr John Lunke. Specimen. Cyst from the mesentery. It consists of an irregular globular mass being largely, from the external appearance, divided into two unequal parts, the larger measuring 10 by 6 cm. and the smaller 6 by 4 cm. The external surface of the mass is quite smooth and glistening. On this surface are many small tortuous blood vessels.

Part of the structure which seems to tend to divide the mass appears to be a tubelike structure resembling a portion of the intestine, while the rest is a bandlike structure composed of two membranes with an intervening loosely woven tissue.

On opening, the mass revealed eight pouches, all of which communicated. With but two exceptions the communications are large and wide, so that one cannot state whether the whole mass is the result of a confluence of eight smaller cysts or whether these cavities are the result of a bulging of the wall of the original cyst.

The lining of these cysts is smooth and glistening.

The mass contained 300 cc. (an equal amount had previously been evacuated) of grayish yellow fluid, the chemical examination of which is as follows: Reaction, neutral, albumin, abundant, mucus, none, pseudomucin, none, sugar, none, urea, 0.3 per cent, specific gravity, 1.012, NaCl trace, neutral fat, small quantity.

Microscopical examination (fluid). Cholesterol crystals, many, erythrocytes, many, a granular, apparently cellular, body the nature of which could not be determined.

For microscopical purposes parts of the cyst-wall were taken from various places.

Histology The cyst-wall is composed of three parts, one being very distinct and is composed of fibrous tissue and has the appearance of a basement membrane, but at no point can epithelium be seen, nor is there any evidence which would lead one to believe that epithelium had ever been present. One is not able to state that such cells might have been present at one time. Of the other two parts differentiation is difficult, one blending into the other. The middle part is mostly composed of muscle and elastic tissue in which there are a few round rather deeply staining cells not at all unlike connective-tissue cells. The third part is principally composed of fibrous tissue. Those portions of the cyst wall taken near the mesentery contain, among the adipose tissue adjacent to the wall, one lymph-gland which is normal in every respect.

Remarks Gross and microscopic study divulges nothing as to the origin of the cyst. There is no proof by means of which one can rule out an omphalomesenteric cyst any more than there is present anything which would prove it to be such a structure. There is nothing by means of which one could say that the cyst is the result of a dilated lacteal nor is there any proof of an enterogenous origin. The small quantity of fat present would tend to make one rule out the dilatation of a lacteal.

CASE 2 Male, age 54, Grady Hospital service. This patient had had a left sided oblique inguinal hernia for 15 years, and a similar hernia on the right side for 6 years. Both had been progressively increasing in size. He had worn a truss intermittently for two years prior to coming to us he had been unable to reduce the left sided hernia.

Patient entered hospital for hernia operation. Upon examination there was found as a part of the contents of the left hernial sac a pinkish globular mass not connected with the testicle, apparently containing fluid. It was too large to be returned through the hernial opening. No diagnosis as to its character was made.

At operation the mass proved to be a cyst of the mesentery (Fig. 2). It approached to within one inch of the intestine. It was enucleated without difficulty. Its wall was rather thick. Its greatest diameter was about $3\frac{1}{2}$ inches. No effort was made to determine what part of the small intestine was involved. The patient recovered promptly.

Remarks Moynihan refers to a patient of Morton's in whom the irreducibility of an inguinal hernia was due to a blood-cyst. So far as I am able to discover, no other mesenteric cyst has been found in a hernial sac.

There is no way to determine whether this cyst originated before or after the descent of the mesentery into the scrotum. If it originated before such descent it had increased in size since it passed through the inguinal canal, since it was too large to be returned into the abdomen.

Laboratory examination by Dr. A. H. Bunce. This specimen of tissue consists of portions of a cyst-wall. A part of the outer surface is covered by peritoneum, the remainder shows many adhesions of fibrous tissue. The inner surface is rough and irregular, the thickness of the wall varies from 1 to 5 cm.

Histologic sections through the wall show that it is made up entirely of fibrous connective tissue. There are only a few blood vessels present and these have very thin walls. Much round-cell infiltration is present, and in some areas there is considerable hyaline degeneration. No definite layer of lining cells is present. Hence the histologic examination sheds no light on the origin of the cyst.

The fluid is clear, straw-colored, and has a specific gravity of 1.022. Its reaction is alkaline. No reducing substance is present. Proteids are 4.7 per cent, fats approximately 74 per cent. A trace of cholesterol is present.

Microscopically there are many lymphocytes, a few red blood cells, and much detritus.

The fluid is sterile.

CASE 3 Male age 32, referred by Dr. C. M. Walker, Westminster, S. C. Patient presented himself for severe attacks of abdominal pain in the upper right quadrant recurring every one to three months, and covering three years. These seizures were accompanied by vomiting and distention. There was always difficulty in getting the bowels to move. His digestion had been bad for a year. He had lost 15 to 20 pounds in weight. The attacks came on and disappeared suddenly, and were not accompanied by fever or chills. His symptoms were always distinctly abdominal. The patient was not jaundiced, and had not been previously.

The patient was seen some three days after an attack. He had tenderness and an ill defined immovable mass in the right upper quadrant. The urinary findings were negative. The patient was supposed to have gall stones with complications of a subacute inflammatory nature.

At operation there were disclosed three cysts lying in the mesentery of the colon at the hepatic flexure (Fig. 3). The outer one of these pushed down behind the terminal ascending colon for a short distance, the others were in the mesentery of the transverse colon reaching nearly to the midline. They were crowded closely upon each other, and the colon was quite taut over the mass, which had, roughly speaking, a diameter of six inches, though irregular in shape. They were enucleated by incising the outer layer of the mesocolon at the hepatic flexure and working thus inward. The first portion of the duodenum was lifted by the mass as it lay *in situ*, the third portion evidently suffered by being pressed backward against abdominal wall.

The patient has gained 30 pounds and remains well two years after operation.

These cysts were thin walled and contained clear straw colored fluid. Through an inadvertence the specimen was thrown away so that no careful examination was made.

The loss of this specimen was quite unfortunate, particularly because I found lying against the inner wall of the cyst nearest the midline a nodule three fourths inch in diameter which was opened during the operation and which I was sure contained oily matter and hair. The lack of later and more deliberate opportunity to study the specimen, however, prevented such verification of the dermoid character of the nodule as would justify an unequivocal statement that it was such. Dermoids of the mesentery, especially in the male, are so extremely rare that one hesitates to so classify this cyst without indisputable evidence.

THE TREATMENT OF ANGIOMATA BY THE INJECTION OF BOILING WATER (WYETH METHOD)¹

By FRANCIS REDER, M D, F A C S, SAINT LOUIS

IT may prove of interest to preface my remarks on the treatment of angiomas with a short résumé, setting forth some of the characteristics of these vascular tumors. In speaking of a blood angioma we designate a tumor composed of dilated and abnormally arranged blood-vessels in thin trabeculae of connective tissue. These tumors present such clearly defined pathological features that they may be conveniently divided into the superficial or simple and the deep or cavernous.

The simple angiomas, the so called port-wine stains and mother's marks, usually occupy the superficial layers of the cutis. They may, however, be harbored in the subcutaneous or submucous tissue and assume the form of fairly large swellings.

In their construction they consist of tortuous and dilated capillary vessels, embedded in a small quantity of connective and adipose tissue. It is not unusual to find the involved area of skin slightly elevated. If these newly formed vessels are very abundant, if there is a marked thinning of the epidermis and a flattening of the papillary bodies, the condition will be designated as a cavernous naevus.

The discoloration of the simple angioma, which imparts to it one of its chief characteristics, depends upon the depth of the affected vessels. If they are superficial, the markings usually appear red, and when subcutaneous a purplish or bluish color is imparted. The color of a simple angioma can be made to disappear by pressure, temporarily restoring to the skin almost its normal whiteness, but as soon as the pressure is relieved the discoloration returns.

These angiomas possess no clinical significance. Exclusive of the unsightly appearance of some they cause no discomfort, and it is not often that the possessor of a port-wine stain seeks advice as to the possibility of having it removed. Even so, should the

angioma involve a large area, which they not infrequently do, nothing of an encouraging nature as to its total or even partial removal can be promised.

An interesting fact in connection with capillary angioma is that their distribution quite often corresponds to the area of distribution of the three branches of the fifth cranial nerve, viz., angiomas of the frontal germinal area, angiomas of the superior maxillary area, and angiomas of the inferior maxillary.

Barrensprung was the first to call attention to this, and his observations were later confirmed by Cushing and others.

Simon entertained a similar theory. He became impressed with the idea that nutritive disturbance in the region of the trigeminal was causal in producing such a condition.

Lamy also, in his interesting exposition of this lesion, adheres to a theory that angiomas are congenital vascular productions caused by modifications occurring during embryonal development.

Virchow advanced a theory that angiomas find their origin in the embryonic relations when slight irritative conditions about the margins and the circumference of the foetal clefts, which are always copiously supplied with blood vessels, may cause an abnormal development about these parts, with the possibility of a naevus formation. Such a condition may remain latent for a time, and later manifest itself as a cavernous angioma.



All glass syringe small size, for injecting boiling water into an angioma. Note the asbestos plunger, the large ring at the end of the piston, the shoulder of the barrel and the point of the barrel ground to receive the 'clip' needle.

¹Read before the Southern Surgical and Gynecological Association, Asheville, North Carolina, December 15-17, 1914.



Baby C

Baby C age 2 years. Angioma of lower lip in left corner of mouth. When baby laughed this tumor would roll out of corner of mouth and appear as large as a California grape dark purple in color. Three injections obliterated the tumor. First injection April 6, 1914, 0.5 ounces. Second injection June 3, 1914, 0.5 ounces. Third injection October 11, 1914, 0.5 ounces.

Baby E age 3 years. Angioma involving left upper eyelid. This tumor grew rapidly during the last four months and interfered with vision. Two injections obliterated angioma. First injection, January 3, 1912, 2



Baby E

ounces. Second injection March 1, 1912, 1 ounce. Disappearance of tumor by July 1, 1912.

Baby G age 18 months. Angioma of right cheek, complicated with a nevus. Four injections obliterated the angioma. First injection, September 10, 1913, 3 ounces. Second injection October 12, 1913, 3 ounces. Third injection, December 6, 1913, 2 ounces. Fourth injection February 18, 1914, 2 ounces. The tumor had entirely disappeared by June 1, 1914. The nevus was destroyed with two applications of von Paquelin's cautery.



Baby G



Peter I

Peter I, age 10 years. Angioma on tip of nose and underneath upper lip. Two injections required for tumor underneath the upper lip and three injections for angioma on tip of nose. Owing to the cartilaginous structure of the tip of the nose much difficulty was experienced in making these injections. First injection June 2, 1911, nose, 0.5 ounces; lip 2 ounces. Second injection July 8, 1911, nose 0.5 ounces; lip 1 ounce. Third injection, September 2, 1911, nose, 0.5 ounce. Complete disappearance by October 1, 1911.



Albert H

Albert H age 4 years. Angioma of tongue. Two injections obliterated the angioma. First injection, May 8, 1911, 2 ounces. Second injection June 22, 1913, 1 ounce. Disappearance of tumor by September 1, 1913.

Baby M age 7 months. Angioma of lower lip. One injection of boiling water obliterated the angioma. The angioma was injected with 1.5 ounces January 5, 1914. There was complete disappearance of tumor by April 1, 1914.



Baby M



Mr F, age 32 years. Angioma behind right ear extending well down on neck. This patient had been subjected to a surgical measure with almost fatal result. Two injections were sufficient to cause obliteration of the angioma. First injection, March 14, 1909, 6 ounces. Second injection, April 18, 1909, four ounces. Tumor mass practically disappeared by June 1, 1909.

Mr F. Appearance of patient June 1, 1909

He has applied to them the name of "angioma-fissurax."

According to Ribbert, the genesis of angioma rests with two questions. Is the tumor a simple dilatation of the vessels in a circumscribed area? Or is the tumor the result of a new-growth? To this may be added Stangl's argument as to whether or not these tumors are of epithelial or connective-tissue extraction. Ribbert advocates the view that these vascular tumors are the result of a new-growth. It is true that their histological formation closely resembles certain types of malignancy, yet, clinically, angioma are considered non-malignant. That angioma are congenital in their origin is no longer a disputed fact.

Cavernous angioma is the type of vascular neoplasms in which the interest of this paper is centered, present a pathology that microscopically does not differ from the simple angioma. It is only macroscopically that its characteristics overshadow the latter.

A practical definition for a cavernous angioma would be that it is a soft, non-pulsating swelling, of variable size, with a thin covering of skin, usually bluish in color. Its great differential factor is that the entire tumor can be caused to disappear upon pressure, with a prompt return to its original size as soon as the pressure is removed.

These vascular neoplasms present individual characteristics. Particularly is this true when some of the vessels entering into the formation of the tumor empty arterial blood in sufficient quantity into the spaces to cause a distinct pulsation.

Furthermore, the connective tissue enmeshing the vessels is sometimes scanty and sometimes plentiful, thus causing irregularities in the circulatory apparatus of the angioma with a resultant lobulated appearance of the tumor.

An additional individual characteristic of import is that a cavernous angioma is responsive to the temperament of the possessor, excitable influences causing the tumor to swell, become tense, and more deeply colored.

The construction of a venous angioma

Are there any dangers connected with the injection of boiling water into these neoplasms? The reply must be promptly given in the affirmative.

An injudicious use of boiling water may result in the sloughing of tissues, with a resultant infection. After an arduous delay cicatrization will take place, adding an additional defect to the already existing one. I may state here that it is not a simple matter to judge a boiling-water injection properly. If the angioma is in the neighborhood of the eye, the injection must be given with the greatest care, lest an injury to that organ should result. Another matter, and one of vital import, is the danger of embolism. To preclude as far as possible such a danger, peripheral compression while the injection is being made becomes imperative. These are possibilities that must be reckoned with. They weigh heavily upon the mind of the surgeon who deals with boiling water and a cavernous angioma.

In making the injection certain conveniences will expedite this measure. A suitable syringe is essential. I have found an all-glass syringe with a good shoulder, a large ring on the piston, and an asbestos plunger answers the purpose better than any of the many I have tried. A syringe with an all-glass plunger has its drawbacks, inasmuch as the steam generated within the barrel will find its way between it and the glass plunger, thus inhibiting the free and easy movement of the piston so essential to this procedure.

The slip needle (small caliber) is the preferable one. With it no time is lost in the transference of the boiling water. It should always be borne in mind that the water must be injected as near the boiling temperature as is possible, and time is an important factor.

A pair of easy-fitting chamoisette gloves of good thickness have served me well. That portion of the glove intended for the little finger is cut off, so that the degree of heat in the tissues can be judged by occasional contact with the little finger.

The arrangement in the operating room should be such that the surgeon stands between the vessel containing the boiling water — this vessel being kept constantly at the

boiling point over a flame — and the patient, at a distance that will not necessitate a step on the part of the surgeon for the transference of the boiling water into the tumorous mass.

The parts not involved in the tumor should be protected with moist cloths, lest a scalding of these tissues result from the hot water in the syringe being forced out by the generated steam.

The introduction of the needle and the force applied in injecting the hot water are of great importance. Inasmuch as the weak tissues of the new-growth do not offer the resistance of normal skin, which overlies the angioma, the hot water injected without great care may cause these tissues to break down. Injections made directly into the enlarged capillaries are invariably followed by a necrosis. For this reason it is well to make the initial injections through the sound skin about one-sixteenth and one eighth inch from the edge of the angioma, well beneath the neoplasm, thus assuring coagulation of the deeper parent vessels. This is also a wise precaution against the dangers of embolism.

If the arteries leading into the tumor can be demonstrated, it is well to enter the needle along their course and inject a sufficient amount of boiling water to cause coagulation in these vessels.

Judgment should be exercised, in introducing the needle, to prevent the point from resting too near the opposite wall of the tumor. To estimate this procedure properly it is well first to introduce the needle without the syringe, pushing it through the mass till it can be felt on the opposite side, then withdrawing it to the extent of a half-inch. This will give a reasonable assurance that the boiling water can be injected into the tumor without the probability of sloughing. When the skin begins to turn grayish in color the injection into that area is to be discontinued. Hyperdistention must be carefully guarded against. The amount of hot water necessary to cause this bleaching rests wholly with the amount of tissue under treatment. After coagulation of this particular area has been satisfactorily accomplished, the point of the needle is made to penetrate into an-

other area and the hot water injected. In this manner the needle is introduced into the tumor in different places, always from side to side, and at various angles, until the whole mass gives evidence of coagulation.

The quantity of hot water which may be injected at one sitting can be as much as three or four ounces in a tumor the size of a hen's egg, the time consumed in making the injection being about ten minutes. However, if the new-growth is of unusual size, it would be advisable to inject only a portion of the tumor at one time, making a subsequent injection two or three weeks later.

Angiomata under treatment with hot water must be scrutinized closely and the areas that have not been affected must be dealt with. In this manner a tumor the size of an orange may require two to four injections, the period of time for a cure being two to five months.

It is interesting to observe the characteristics presented by an angioma subjected to the hot-water treatment. The independence of the blood spaces from the blood-vessels of the surrounding tissue can be demonstrated by the fact that the neighboring tissue is not affected, i.e., none of the hot water finds its way into the adjacent structures while the injection is being made. However, shortly after the injection an oedema of the immediate parts begins to manifest itself. This oedema may be very extensive, according to the amount of hot water injected. Frequently, when the lesion is on the face, the swelling may become so extensive as to close the eyes. Although the condition looks alarming, there is little ground for actual fear. The patient suffers no pain, the condition is an afebrile one, and the oedema usually subsides within the first week. It is a wise precaution to apply ice or very cold compresses to the tumor and surrounding tissues immediately after the injection for the first four to six hours, thereby lessening the severity of the oedema.

At the end of the first week the tumor, but slightly diminished, has almost fully lost its pathological color, and the tissues are beginning to assume a normal appearance. To the touch the mass is hard. If it remains hard the degenerative process is active and no

further injection will be necessary. Should the tumor, however, begin to show evidence of softening, with visible formation of new blood-vessels, an immediate injection is indicated.

The course of an angioma successfully injected is one of gradual diminution, the greatest progress being made from the second to the third week. A tumor the size of a hen's egg will usually require six to eight weeks for its disappearance. If the injection has been a fortunate one, i.e., free from any accident, such as cicatrization following sloughing, the site that once harbored the angioma will appear healthy and quite normal.

To illustrate the gratifying results of this hot-water injection, the history of two cases will be found interesting.

CASE 1 Miss S., age 22, always in good health, splendid physical proportions and excellent physical condition, inclined to suffer from periods of marked depression. Since childhood had a small bluish spot on her upper lip and immediately below left eye upon malar prominence. Seven years ago the bluish spot on the lip began to enlarge. It continued to grow very gradually and was the size of a tangerine when she presented herself to me June 6, 1906.

This was the condition of her face. The right side, excepting two thirds of the portion of the upper lip, was normal. The left side showed a marked swelling of the cheek which pushed up the lower eyelid and encroached upon the left ala of the nose. About the malar prominence was an elevated bluish spot as large as a pea. The left nostril was considerably flattened, about one half normal. Two thirds of the cheek showed involvement in a tumor mass that hung down over the under lip within one-quarter inch of the margin of the lower jaw. The tumorous mass was of a dark-blue discoloration and was convoluted. Upon stooping, this mass would increase in size very perceptibly. The swelling was soft, the skin covering it appearing very thin to the touch. Upon pressure it could readily be made smaller by forcing the blood out of it. The evidence that there were cavities filled with fluid was unmistakable to the touch. The protrusion of the tumor was such that it was on a level with a line drawn from the tip of the nose across the cheek and down to the chin. The lower lip and the chin showed atrophic changes corresponding to the shape and contour of the tumor, caused by pressure of the overhanging mass. The incisor and canine teeth of the upper jaw had long been destroyed by the constant attrition of the tumor. Within the mouth there could be seen large bluish masses of mucous membrane lying between the molar teeth and filling about one third of the cavity of the mouth, causing an impediment of speech. Fear of biting this mass

during mastication and causing free bleeding was a constant source of danger. It was a great discomfort to the patient because of the difficulty in eating. The patient carried the tumor in a sling partly because it relieved the weight and partly because it hid from view the unsightly mass.

Having had no previous experience with the hot-water injection, I spoke very discouragingly to her because I did not know how much good or how much harm I might be able to do her should I undertake to interest myself in her behalf. She had consulted a number of physicians, good and bad, during the past six years, seeking relief, but invariably returned home downhearted and discouraged.

The idea that occurred to me at first was to reduce the pendulous part of the tumor with the procedure that incurred the least amount of risk. I thought this to be the ligation method—strangulation by introducing loops of silk subcutaneously along the mucocutaneous margin of the lip. With a very small cambric needle I ligated the lower third of the tumor. Small as the punctures were, the bleeding was most obstinate, continuing for sixteen hours. With the aid of ice and pressure it was checked. The experiment demonstrated that it was not the procedure to be followed. The threads became infected and were removed on the fifth day. After nine days the infection had subsided. The condition remained the same, excepting that about one half inch of the lip on the right of the median line had contracted, furthermore, hard nodules could be felt throughout the portion that had been ligated.

The condition as it presented itself after two weeks gave me considerable encouragement, and I concluded to resort to the treatment of injecting boiling water. The risks seemed to increase while I was debating with myself as to the advisability of using this method, and I spoke very frankly to the patient of what might happen. This case seemed to me to be one particularly prone to risks inasmuch as so much mucous membrane had to be dealt with. To inject boiling water into spaces filled with blood seemed to me an operation not free from danger.

The first injection, under aseptic precautions, was made on June 25, 1906. Under ether narcosis, four ounces of boiling water were injected into the tumor. A small aspirating needle, three inches in length, was inserted into the swelling through healthy skin on the right cheek, about one eighth of an inch distant from the tumor margin and about one half inch below the nose. In making these injections, the advice of Dr. Wyeth was closely followed. All of the tumor was injected excepting the portion on the inside of the cheek. About fourteen minutes were required to inject the four ounces of boiling water. Time was lost by not having been able to obtain a Wyeth syringe. An ordinary glass syringe holding two ounces was used, the aspirating needle being attached to the syringe with rubber tubing. It was a clumsy way of doing this work, but it answered the purpose satisfactorily.

The handling of boiling water is a rather delicate task.

While the injection was being made, the patient's face was protected in the immediate vicinity of the needle so that the boiling water which was being forced out at the needle junction by the confined steam would not scald the skin. The hands of the operator were protected by a folded towel. It did not serve the purpose well, and to those who have occasion to handle boiling water I would suggest the use of heavy duck gloves.

To anticipate as far as possible any danger from embolism, peripheral compression was applied. In introducing the needle, it was carried through the mass till the point could be distinctly felt through the skin. The withdrawing of the needle about one half inch gave a reasonable amount of assurance that the boiling water could be forced gently into the diseased area without much danger of provoking any sloughing. The needle was introduced in four different places at various angles. In some places the integument turned pale, in others an ashen gray, while the water was being injected into the tumor. The heat of the water could be very distinctly felt through the tissues—they were hot.

After the operation the patient was put to bed. The following day the left side of the face was very much swollen, but not painful. The left eye was partially closed. A large blister had formed along the mucous border of the lip. The tumor felt hard to the touch. There was a slight rise in temperature (99.6°). Two days later the temperature returned to normal. The patient left the hospital on the fifth day. On July 26th a large scab that had formed on the lip margin was removed. The whole tumor was hard, excepting about two thirds of the tumor mass inside of the cheek. Diminution by granular metamorphosis had reduced the tumor to one half its original size. I wish to state here that a linear sloughing of the skin occurred which extended from the ala of the left nostril to the margin of the lip. It resulted in a cicatrix that was but slightly disfiguring. This scar was removed subsequently.

On August 2nd, under ether anaesthesia, the buccal mucous membrane was injected with three ounces of boiling water. The outcome was most favorable, only a small slough resulting.

On August 18th under ether anaesthesia two ounces of hot water were injected into the lip. Some difficulty was encountered in introducing the needle on account of the hardened condition of the tissues.

On August 30th without anaesthesia one ounce of boiling water was injected into the buccal mass.

On September 15th conditions began to take on a normal appearance.

On September 23th, without anaesthesia, one ounce of boiling water was injected into the outer portion of the lip, which still appeared quite large. Ten days later the lip was almost normal.

On October 8th an injection of one ounce of alcohol caused the lip to assume so near a normal condition that further intervention was deemed unnecessary and the patient was discharged.

In substituting alcohol for boiling water, I wish to state that I feared too much of a contraction might take place with the use of boiling water and cause a deformity of the lip. I felt assured that in using alcohol the contraction would be but very little.

CASE 2 Mr F., age 32, carriage painter, never seriously sick, was referred to me by Dr. C., Quincy, Illinois.

As far back as fifteen years he had experienced attacks of dizziness. During the last two years he had been unable to follow his trade as carriage painter on account of the severity of these attacks. Has had a small swelling behind his ear as long as he could remember. Four years ago the swelling had grown to such a size that it crowded his right ear forward and extended into his scalp and down upon his neck.

The condition of the tumorous mass when he consulted me, March, 1909, presented these characteristics. Extending from the mid parietal region near the center of ossification on the right side down to the clavicular region, the tumor occupied the entire right half of the occipital region, crowding the right ear markedly forward. The contour of the tumor was clearly defined. The mass proper was elevated to a level with the helix of the ear. That portion of the tumor involving the neck was of a bluish discoloration. Upon palpation a distinct pulsation and a bruit were readily detected.

With the application of pressure the contents of the swelling could be forced out easily. Upon releasing the pressure the tumor promptly reappeared. With touch the roughened bone margins and many irregularities of the skull underlying the tumor could be distinctly discerned. This destruction of bone was caused by attrition of pulsating mass.

About the lower pole of the tumor were a number of cicatrices, the result of an attempted operation. The patient informed me that he almost perished from loss of blood when the operation was undertaken.

The condition of this patient was one of extreme distress. The ringing and noises in his right ear were incessant. He was unable to be on his feet on account of vertigo and was compelled to sleep in a sitting posture.

An attempt was made to administer an anesthetic preparatory to the injection of boiling water. This, however, was found to be too hazardous a procedure, the influence upon the tumorous mass being such that it appeared as though it would burst.

The injection of hot water was made without an anesthetic, and about six ounces were introduced. In making the injection, all factors of safety were considered: the scalp had been shaved and cleaned, and during the injection peripheral compression was diligently exercised.

In making the injection the needle was first introduced at the lower pole in the neighborhood of the vessels that led into the tumor. As soon as there was evidence of coagulation, following the injection, the needle was withdrawn and reinserted into the tumor at a different site. The needle was introduced about one-fourth inch from the mass. In this manner the whole of the tumor base was injected. After six ounces of hot water had been introduced into the mass it ceased to pulsate. While the injections were being given, cloths wrung out in ice water were frequently applied to the mass, which had become quite hot.

The condition of the patient following the first injection, exclusive of the enormous swelling that followed (the edema involved the right side of the face, closing the right eye and encroached upon the neck, throat, and chest) was very encouraging. He appeared more comfortable; the ringing in his ear had ceased and he was able to lie in bed. At the end of four weeks the growth had diminished to less than half its size. The patient could sleep well and was able to walk about without experiencing dizziness. A second injection of about four ounces of hot water was given at that time. Six weeks later the tumorous mass had practically disappeared, excepting a small mass the size of a pigeon's egg at the angle of the mandible which had the appearance of an enlarged gland. An attempt was made to inject it but the substance was found to be too resistant.

RÖNTGENTHERAPY IN NON-MALIGNANT DEEP-SEATED LESIONS¹

By JAMES T. CASE, M.D., BATTLE CREEK, MICHIGAN

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THE application of rontgentherapy to skin lesions was the earliest therapeutic development of rontgenology. Later, the attention of the early investigators was directed toward securing effects in deeper structures, but owing to the imperfections in tubes, generating apparatus, and methods of technique, only desultory results were attained during the first decade of rontgenologic history.

Several recent technical developments, combined with special experimental and clinical studies of the last five years have given a new significance to the term "deep rontgentherapy." The writer refers first to the invention of the Coolidge tube, which has placed in the hands of rontgenologists a very powerful, but precise instrument, with the use of which it is possible to control the dosage with very great practical accuracy, second, the perfection of newer and more powerful sources of high tension current, and, third, the development of a technique involving filtered irradiation at short focus skin distance through multiple skin areas.

My colleagues² on this evening's program were among the first to apply the methods which have come to be known as deep rontgentherapy. Williams, Boggs, Johnston, Hulst, Pancoast, Hickey, Crane, Lange, and Dachtler are some other Americans who have contributed materially to our knowledge of this subject, in which American physicians have kept well abreast of our European confrères.

Necessity for accurate dosage. The empiricism of early rontgentherapy persisted for a number of years, not for lack of effort to determine the physiological effects of the rontgen rays, but because of the impossibility of comparing the work of one man with that of another. Imperfections in apparatus made accuracy in X-ray dosage extremely difficult. Statements as to technique and

dosage employed were so vague that much of the very exhaustive and painstaking experimental work of the older writers cannot be correlated with present-day researches concerning the effects of the rays. As a result, the present-day literature on rontgentherapy often shows a curious mixture of the old and the new—pouring new wine into old bottles, so to speak.

The record that in a certain experiment certain animals were treated fifteen minutes and other animals twenty minutes, or that one patient received two thousand minutes of treatment, or other similar incomplete statements with reference to the dosage, are very misleading. If one states that a certain number of X (Kienboeck) units or H (Holzknecht) units were administered to a given area, within a certain time, with or without a certain amount of filtration, such a record is perfectly comprehensible to all rontgen workers. In the absence of specific statements as to dosage in units, references to methods of treatment must include the following: Milliamperage, length of treatment, focus skin distance, hardness of tube (either according to some standard penetrometer, or expressed as the equivalent spark gap), details as to the number of areas treated, amount and kind of filtration used, and the frequency of treatment. It is absolutely essential that published reports concerning rontgen irradiations include these technical details, otherwise, in the light of our present knowledge, such reports must be discredited.

The writer does not wish to leave the impression that all the questions relating to the accuracy of X-ray dosage are solved. The factors which govern the amount of irradiation reaching the deep seated tissues are numerous and, in fact, not yet fully determined. But the introduction of certain new tubes which have come upon the market in the last year have made accurate measurements possible and it remains now for rontgen workers to

¹ Dr. Wm. Allen Posey and Dr. G. E. Pfahler² Read before the joint meeting of the American Röntgen Ray Society (Western Section) and the Chicago Medical Society, March 5, 1915

determine and formulate, out of clinical experience, the information still needed in this field. Now that it is possible to control the penetration of the tube with a satisfactory degree of accuracy, it is doubly important that estimates made by different observers under certain stated conditions be in very fair agreement.

Technical considerations It is probably not expedient to devote here any space to the minutiae of the technique of roentgen-therapy¹, and the technical and biological considerations may be abbreviated to a few necessary notes of explanation.

Owing to the differences of the radio-sensitiveness of the various tissues, doses which are sufficient to destroy or modify pathological cells are not always harmless for the normal tissues. The skin, in particular, which itself is very sensitive to the X-rays, allows the absorption of much larger doses than can possibly pass through it to the deeper organs. The skin is therefore the chief barrier to deep roentgentherapy.

Various means have been devised for protecting the skin while permitting the passage through it of large quantities of effective rays. Our colleague, Dr Pfahler of Philadelphia, was one of the first to introduce the use of a leather filter for this purpose. Aluminum filters are also utilized, the thickness varying from one to four millimeters. The writer employs at least three or four millimeters of aluminum plus a thickness of sole leather as a filter in most of his deep roentgentherapeutic work, and sometimes the thickness of aluminum is increased to seven or eight millimeters.

The reasons for the employment of filters are easily understood. The emanations from the roentgen tube consist of a bundle of rays of varying penetration. The softer rays do not pass farther than the skin, the most penetrating rays are capable of traversing not only the skin but heavy filters, and of passing on into the deeper tissues. Filters serve to sift out the softer rays so that the

skin is subjected only to the influence of the very hard rays, a maximum proportion of which are thus allowed to pass into, and be absorbed by, the deeper tissues. The present-day tendency in roentgentherapy, both in superficial and deep lesions, is to use harder rays. It is quite possible that the very hardest obtainable rays are not the most desirable nor the most effective, and that the optimum will fall somewhat short of the hardest obtainable rays, nevertheless, in the writer's opinion, harder rays are needed than are at present available even with the Coolidge tube in its present stage of development, and with the present forms of apparatus and tubes the hardest obtainable rays are utilized.

Besides filtration, special means have been sought for *desensitizing the skin*, among them being the production of superficial anæmia by the application of ice, by the injection or electrical introduction of adrenalin into the skin and by the use of compression. Considerably more than the erythema doses may be safely passed through the skin thus rendered anæmic, but with the progress of our knowledge of filtration and the introduction of more powerful sources of roentgen rays, the need of thus desensitizing the skin seems to have diminished, and it does not find a place in our present technique.

The progress of deep roentgentherapy has gone hand in hand with the increase of our knowledge of filtration and cross-fire irradiation. *Cross-fire irradiation* is the term applied to the method by which one passes a bundle of rays of high penetration through the different surfaces of skin which surround the region under treatment, for instance, the anterior, posterior, and lateral aspects of the trunk if one is irradiating an abdominal tumor, or the anterior, posterior, and lateral aspects of the neck in the treatment of goiter. The principle of cross-fire irradiation may be considerably elaborated by dividing each of the surfaces in the neighborhood of the organ into a number of areas and directing the rays through each of these areas in succession, carefully protecting all except the one actually under treatment, thus introducing through each skin area the maximum dosage of filtered ray which the superficial tissues can

¹ See two recent papers in press.

(a) James T. Case, M.D.: Coolidge tube technic in deep roentgen therapy. Read before the American Electro-Therapeutic Association, Battle Creek, Mich., on September 25 to 27, 1914. (b) James T. Case, M.D., and Edwin L. Jones, M.D.: Technic and recent results in deep roentgentherapy. Read before the American Roentgen Ray Society, September 9 to 11, 1914, Cleveland, Ohio.

tolerate. The amount of effective rays which reach the deeper tissues is increased as many times as there are ports of entry. In certain locations where the skin overlying the organ is very loose, it is possible, by sliding the skin about, to deliver several doses directly over the organ under treatment without overtreating any section of the skin.

It was formerly held that for the irradiation of deeper parts the tube should be relatively farther from the skin than when treating superficial lesions. Inasmuch as the intensity of the X-rays varies inversely with the square of the distance from the anode to the part under consideration, with a shorter *focus skin distance*, it is evident that the tube being brought nearer to the skin, the length of time required to deliver a certain dosage to a deep lying structure will be proportionally diminished. For instance, with a tube fourteen inches from the skin ($14^2=196$), nearly five and one-half times longer will be required to deliver a certain dosage to the skin than when the focus-skin distance is only six inches ($6^2=36$). The former objection to the short focus skin distance was the much greater danger of injury to the skin. Since the introduction of filtration methods, however, this danger of skin injury is eliminated within certain limits, and it is now possible to bring the tube much closer to the skin, thus materially shortening the time required to administer an effective dose to the deep parts. If it were not for this possibility, the length of time needed for the application of deep roentgentherapy would almost preclude its employment.

Wider application of the improved method. These three developments, therefore—the use of filtered rays of high penetration, the method of cross fire irradiation, and the close approximation of the tube to the skin—have rendered possible the practical employment of effective doses of roentgen rays, aggregating forty to one hundred times the maximum doses considered safe nine or ten years ago, in a number of deep-seated affections which hitherto had responded uncertainly to the efforts of roentgenologists, and this great advance has been accomplished without so greatly increasing the necessary labor as to

preclude its practical employment. It must be added, however, that the dangers of attempting the unskilled application of this potent means have been in the same degree increased. Roentgentherapy should be vigorously but carefully and skillfully given. As one expert has aptly put it, the possession of a roentgen apparatus is no more a guarantee of skill in roentgenology than is the possession of surgical instruments a guarantee of skill in surgery.

Biological effects of the roentgen rays. It is a generally accepted postulate that small roentgen doses exercise a stimulating effect upon cell development, while the larger doses give rise to depressant effects. A given dose will be more or less stimulating or more or less depressant to a certain tissue, depending upon its nature, for the rays seem to exercise a selective action. In general it may be stated that the cells most affected by the roentgen ray are those in which the reproductive activities are the greatest, those in which the karyokinetic process is most active and whose morphology and function are the least highly developed. Before beginning treatment it is therefore essential to decide first which therapeutic effect of the X-rays is desired.

In relatively few instances of deep therapy is the stimulating effect of the roentgen rays desirable, most often a depressant effect is needed, and one must exercise the greatest care to make sure that he is not giving a dose so small that it may be stimulant, lest he counteract the therapeutic effect it is desired to secure. This is perhaps most essential in the treatment of malignant conditions, as will be emphasized by another speaker of the evening, but it is also true in most benign lesions. It may be declared that for efficient deep roentgentherapy a constant source of rays of maximum penetration must be assured. It should further be considered absolutely essential to every procedure of roentgentherapy that the dosage be measured as accurately as the present developments of instruments will permit. The writer recognizes that absolute accuracy is not obtainable, nevertheless, it is possible to make such a close estimate of the number of x units delivered through a filter that any competent

rontgenologist will understand and be able to duplicate the technique and the results in a similar case. In fact, it would seem desirable if the practice of rontgentherapy could be limited to those who will equip themselves to administer dosage in definite measurements.

With these introductory remarks the writer will proceed to a brief consideration of some of the more important non-malignant diseases in which deep rontgen irradiation has been employed or in which its use seems indicated.

Leukæmia American physicians were the first to use rontgentherapy in leukæmia, Pu-ey reporting the first case in 1902. Pancoast, Schultz, Senn, Williams, Kleineberger, Pfahler, Boggs, and Johnston are others who have reported excellent symptomatic cures. Pancoast particularly has contributed greatly to our knowledge of this subject.

It has been aptly stated that rontgentherapy in leukæmia is a symptomatic, transitory, therapeutic means. Practically all cases relapse sooner or later and ultimately die, although there are claimed a few exceptional permanent cures. Nevertheless, the prognosis with rontgentherapy is so much more favorable, as far as uniformity of symptomatic improvement and lengthening of life are concerned, that the therapeutic use of the X rays finds in this disease one of its most valuable applications.

In the myeloid form the blood picture generally approaches the normal. In the lymphatic form the pathologically changed blood cells remain practically the same, in spite of the fact that the white cell count may show considerable diminution. On the whole, the effect is more favorable in lymphatic than in myelogenous leukæmia. Bédère, in 1913, reported 110 cases of leukæmia treated with the rontgen rays—twelve lymphatic, ninety three myelogenous, and five acute forms. The lymphatic cases returned almost to normal. In the myelogenous form there was a transitory improvement with always a recurrence. In the acute cases the effects were unfavorable. Cases which have been manifest for less than a year, and in which the leukæmia is not very severe

in grade, offer more favorable prognosis than others. Some cases, both of the myelogenous and lymphatic forms, are refractory to rontgentherapy and give unfavorable results, even as far as symptomatic cure is concerned. In all acute forms the use of the X-rays is contra-indicated.

Favorable signs of successful rontgen treatment are an increase in the hæmoglobin or of the hæmoglobin and the red cells as well as general improvement in the patient's condition. A diminution of the leukocyte count does not, as a rule, appear until a little later. In fact, there may be a temporary increase in the number of leukocytes preceding the fall.

At first treatments were directed over the enlarged spleen in splenomyelogenous leukæmia and over the spleen and other enlarged lymphatic structures in lymphatic leukæmia. While some of the long bones had been treated perfunctorily, no definite campaign had been introduced against the bone-marrow until the work of Pancoast.

In the light of modern research concerning the pathology of this disease, leukæmia may be regarded as a sort of cancer of the blood, the bone-marrow being considered the primary focus of the disease and the lymphatic enlargements as metastases. This is certainly borne out by the greater success of the plan of therapeusis whereby the most energetic treatment is directed against the primary foci in the bone-marrow, as recommended by Pancoast, rather than against the secondary manifestations of the disease in the spleen and other lymphatic organs. The writer has again and again observed that applications over the long bones alone have resulted in a diminution in the size of the spleen and a reduction in the white cell count without any direct exposure of the spleen itself. There are however, exceptional cases which do not thus respond. The average prolongation of life may be estimated at about two years.

Pancoast and several others explain the frequent symptomatic cures followed by a varying period of quiescence, with the older method of treatment as follows. Rontgenization of the spleen and other lymphatic enlargements, through direct destruction of

certain cells, thereby diminishes the size of these organs. Leukotoxic substances, having the power of destroying large numbers of leukocytes, are produced and liberated into the blood, thus diminishing the white cell count. These leukotoxic substances seem also to exercise an inhibitory effect upon the red forming activities of the bone-marrow.

Linser and Helber found that this leukotoxic action could be demonstrated both *in vitro* and *in vivo*. They observed, for example, that the injection of blood serum of an irradiated rabbit into a second rabbit causes a decrease in leukocytes instead of the increase which should follow the injection of normal serum. A number of other workers, however, have achieved only negative results, and the evidence concerning the existence of a roentgen leukotoxin is on the whole still insufficient.

There are some dangers attending the roentgenization of leukemic patients, the avoidance of which requires considerable skill and judgment. There is danger of toxemia following over exposures of the spleen and lymphatics and other tissues especially susceptible to the roentgen rays. This danger is especially great if the early efforts are directed against the spleen, later on after a sort of tolerance has been established by treatment of the bone marrow applications may be directed toward the spleen with considerably less danger of toxemia. It is probable that in certain instances death has been produced by overwhelming toxemia resulting from an over exposure of lymphatic structures at one sitting. The temporary increase in the white cell count which may occur during the period of reduction of the enlarged glands should not be considered as an indication of failure, as persistence in the treatment will finally reduce the count. If toxemia seems imminent, the dosage should be diminished or the treatments should be temporarily discontinued. In very severe cases only one area should be treated daily and one will thus wish to treat the patient every day. When there is less danger of toxemia, several areas may be treated in one day, and the number of days of treatment in each month will be thus lessened.

The danger of "burns" should be considered, but if the first principles underlying the therapeutic action of the rays is understood, no "burns" should occur. The bone-marrow treatment, through furnishing more areas for the entry of the rays, involves less danger of skin injury than treatment confined to the lymphatic structures alone.

The duration of the course of treatment is variable and extremely difficult to decide upon. Unless the patient can be depended upon for at least three months' treatment, roentgenotherapy should not be started, for if the treatment is stopped too soon a relapse is almost certain to occur, and it has been the universal experience of roentgenologists that each relapse shows greater obstinacy in its response to treatment. Pancoast has expressed the belief that a rapid symptomatic cure renders ultimate failure almost certain. It is not sufficient to correct the leukocyte count and to cause the various enlargements to disappear. No matter how healthy and vigorous the patient may seem to be, continuation of the treatment should be insisted upon until the differential blood count has returned to normal and the abnormal blood elements have disappeared. Even then differential blood counts must be insisted upon at frequent intervals, and, at the first sign of recurrence repetition of the systematic course of treatment should be begun at once.

Let it be repeated that after a course of roentgen treatment has once been mapped out it should not be discontinued until all the areas mapped out have been gone over three or four times and the abnormal cell elements have disappeared, for an earlier cessation of treatment practically precludes the probability of a cure, even a symptomatic cure. The prognosis in any case is unfavorable as to cure, even after X-ray treatment, although the symptomatic cure is better than with any other therapeutic method.

Hodgkin's disease. Hodgkin's disease is a condition in which very satisfactory results have followed roentgenotherapy, though the question of final cure still remains. Indeed, except for the hope which is held out to us in recent developments in serum therapy, roent-

genization is the only rational method available in this disease

The prognosis is still undetermined. There is greater likelihood of cure in these cases than in true leukaemia. Pancoast believes the proportion of cures is between 10 and 20 per cent, and in all of the cases which respond to treatment one may expect many months or even years of comparative relief from symptoms. Some patients who, at the beginning of treatment, are helpless from weakness regain strength sufficiently to resume their usual occupations.

In contrast to leukaemia, Hodgkin's disease is a local rather than a general condition. The effects of roentgenization appear to be local, and if any leukotoxin is produced, it does not behave as in leukaemia. Remote lesions are not influenced, there is no effect upon lesions other than in the structures exposed.

Before outlining the treatment it is necessary to study the chest roentgenographically to determine the extent of the mediastinal involvement, and re-examination by means of roentgenograms at suitable intervals may serve to mark the progress of the disease.

As in leukaemia, there is a danger of toxæmia from exposure over too large a mass of lymphatic structures at one sitting. In fact, the toxæmia may appear within the first few hours after heavy treatment. The evidences of toxæmia (headache, lassitude, even nausea and vomiting) constitute the principal guide as to the frequency of treatment.

There is still another danger in these cases, especially when the enlarged glands embarrass the respiration. It is a common observation that the decrease in size which almost invariably follows roentgenization of these lymphatic structures is preceded by a temporary swelling which appears within a few hours after treatment, and may be very marked. The treatment of too many areas in the neighborhood of the trachea at one sitting may result in serious respiratory embarrassment from the primary, though transient, swelling of the lymphatics which is almost certain to occur.

Various forms of anæmia. At the outset it should be admitted that as yet there is

little clinical evidence to warrant the use of roentgentherapy; yet in certain forms of anæmia, roentgenization should, theoretically, exercise a beneficial influence. Small doses of roentgen rays should stimulate the bone-marrow to increased activity. Large doses should exercise a destructive action. In the cases which have been reported it has appeared that as long as the bone-marrow is still capable of responding to stimulation benefit may be expected, but when the degeneration of the bone-marrow has so far progressed that it no longer reacts to stimuli, no good results can be hoped for.

As a general rule, however, generally recognized therapeutic means should be employed in conjunction with roentgentherapy, especially such remedial measures as tend to have a general or constitutional effect for with the exception of a few blood disorders, the action of the roentgen rays is essentially a local action. The writer believes that a trial of roentgen treatment is worth while in every obstinate case, the blood being examined at short intervals in order to decide as to the value of the measure. When the anæmia is not severe, roentgenization should give way entirely to other methods.

In *pernicious anæmia* the roentgentherapy is not only still in the experimental stage, but is attended by such dangers from toxic effects that its use should be restricted to such cases as are distinctly not of toxic origin.

The technique is in general, the same as for myeloid leukaemia except that the dosage is smaller. Filtered small doses for stimulating effect should be applied especially to the knees, shoulders, and elbows and occasionally to the sternum.

In *splenic anæmia* at least according to present theories roentgentherapy should be highly beneficial. Up to the present time the results of roentgen treatment in this condition have not been very encouraging, but the introduction of the Coolidge tube and the other improvements which have been mentioned earlier in this paper inspire hope that in the future the effects of filtered roentgentherapy directed over the spleen, utilizing the cross-ure method by numerous ports of entry, will simulate the effects of surgical

treatment by splenectomy. If splenectomy is a curative means, then also roentgenotherapy should be beneficial. Very heavy doses will be indicated, utilizing the smallest possible areas of entry and as many fields of irradiation as possible, the only limitation, with proper technique, being the danger of producing toxic effects.

The thyroid gland. The hypertrophic goiter of adolescence responds fairly well and may be permanently and considerably reduced in size, although complete disappearance of the enlargement is hardly to be expected. In *cystic goiter* the effects of roentgenization are very unsatisfactory, practically the only result of prolonged treatment being a possible arrest of the growth of the gland.

In *Graves' disease*, however, roentgenotherapy has given excellent results in the hands of the majority of experienced roentgenologists. The treatment is not merely symptomatic but because of its effect in depressing the secretory function, has the character of an etiologic therapy, since it is aimed at the cause of a disease whose essential pathological feature is an exacerbation or aberration of its secretory functions, with resulting toxemia.

The effect of the rontgen rays upon glandular secretions in general is especially marked the secretion of certain accessible glands being almost completely inhibited after rontgen exposure. This is especially noticeable after intensive applications to the neck, jaw, and face in the treatment of lesions of the lip or tongue, as, for instance carcinoma. After treating carcinoma of the lip and the related glandular areas, giving massive doses under strong filtration, the writer has often observed that within twelve hours the patient's salivary secretions have been dried up and have remained so for many days. When series after series of such treatments are given the drying up of the salivary secretions comes to be a very great inconvenience to the patient. This by effect of the rontgen rays on the salivary glands in treating carcinoma of the lip or tongue must strengthen our faith in the efficacy of roentgenization of the thyroid gland where the patient's symptoms are due to an abnormal secretory activity. This depressant effect constitutes the basis for our

plan of treatment, and indicates that a very heavy dosage must be given in order to secure certain results.

The permanent effects in Graves' disease depend upon the course of the disease before treatment. The shorter the duration of the disease or the shorter the time since there was any marked change for the worse the more permanent the results. A pathological condition that has been uniform for years demands long treatment. Cases that have rapidly increased in severity yield quickly after the beginning of treatment. Where acute exacerbations occur in chronic cases, rontgen treatment is indicated with fair prospect of good results, but in chronic cases without exacerbation, or with only slight exacerbation, especially when myocarditis threatens, rontgenization is not indicated.

In favorable cases the nervousness and tremors are the first symptoms to subside. There is next an improvement in the tachycardia and respiratory symptoms, and last of all the exophthalmos and glandular enlargement are seen to diminish. The enlargement of the gland the protrusion of the eyes and some tachycardia are likely to persist but there is good prospect that the distressing symptoms will be permanently improved.

It is highly important that attention should be given to general therapeutic considerations in these cases because of the toxic symptoms which may develop. Not every case will be cured by any means, but the method is worthy of trial in every case where it seems desirable to avoid operation and it may even be required in connection with operation in certain cases where the expected good results do not appear or are not sufficiently marked.

It has recently become a practice with some physicians to require a rontgen examination of the chest in all cases of thyroid enlargement to determine whether or not the thymus is enlarged. Even where no thymic enlargement can be demonstrated, pre operative treatments applied to the thymic, as well as the thyroid regions, improve the prospect of beneficial results.

The writer here would like to take issue with the opinion often heard that rontgen

treatment is not indicated in thyroid cases, for the reason that when it fails operation is rendered much more hazardous and difficult, owing to increased adhesions and greater danger of hæmorrhage. The majority of experienced röntgenologists will agree in this point at issue, disputing the opinion that röntgen treatment causes adhesions which make operation more difficult. As a matter of fact, pre operative röntgen treatment should tend to thicken the capsule and the walls of the smaller blood vessels, which theoretically would favor the outcome of the operation instead of hindering it. Adhesions and unusual hæmorrhage are encountered in just as many cases never treated by the X rays as in those cases which have undergone pre operative röntgenization.

Patience is required in the handling of these cases. No patient should be accepted for röntgen treatment unless the röntgenologist can be assured that the patient can be depended upon for at least four series of treatments, covering a period of twelve or thirteen weeks. With our modern technique the majority of these cases will show a favorable response in less time than this. Occasionally one finds such improvement that further treatment seems needless. In cases of apparent failure of X-ray treatment, where operation is finally decided upon, nothing has been done to jeopardize the patient's interest.

Thymus Röntgenization in the treatment of thymic asthma is a well-established therapeutic measure. In infants a very short series of treatments is adequate to produce results which seem almost miraculous. In older children, and particularly in adults, the treatment must be considerably prolonged. Our utmost technical skill and judgment in the arrangement of areas for cross-fire are demanded. In such cases the writer irradiates the thymus through from twelve to sixteen areas—at least four anterior, four posterior, one obliquely through each supra-clavicular space, and one or two obliquely through each axillary region, the arm upraised.

The writer has seen nothing in the way of toxic effects following massive dosage in this condition, although such effects should be

watched for and the treatment arrested accordingly. Great credit is due to Lange of Cincinnati, Stoerck, and others who have carried on extensive experimental work on röntgen therapy in this condition.

As above noted, röntgenization of the thymus is probably indicated in most cases of Graves' disease in addition to the treatment over the thyroid gland itself.

Uterine myomata Concerning the use of röntgentherapy in gynecology, there has arisen a great deal of discussion and considerable difference of opinion. Some gynecologists summarily dismiss the subject as not worthy of consideration. On the other hand, some have become so enthusiastic as to prophesy that in the future the majority of women suffering from myomata and metropathies who have recourse to a hospital will be treated by röntgentherapy.

There is a middle-of-the-road tendency in this country and England, however, to discount somewhat the estimate placed by our Continental colleagues upon the value of röntgentherapy in gynecology. Donald, of Manchester, for instance, reports a series of 201 operated cases in which there were complications in forty-four, or nearly one-fourth of the cases, thirteen ovarian cysts, twelve cases of red degeneration, six cases of supuration in tube or ovary, four cases of appendicitis, five cases of calcareous degeneration, two cases of fibrocystic tumor of the uterus, two cases of carcinoma in the fibroid, two cases of adenomyoma, one case of necrosed polypus, and one case of hydro-peritoneum.

It is manifestly important that a correct diagnosis be made before the case is submitted to the röntgenologist, and yet nearly all the complications in the forty-four cases referred to by Donald could have been, and doubtless were, diagnosed prior to operation, and hence would be declared to indicate operation rather than röntgentherapy. The difficulties in gynecological diagnosis are most common in the effort to differentiate inflammatory masses and adherent ovarian or tubal tumors from fibroid tumors of the uterus, and especially when they occur in association with uterine fibroids. Malignant degeneration of tumors,

which unfortunately occurs, though in a very small percentage of cases, is another contra indication to X-ray treatment, except as a last resort in inoperable cases and as a post-operative measure. The writer is an advocate of routine post-operative roentgenization in all malignant cases.

In contrast to the foregoing array of difficulties and discouragements in the way of roentgentherapy of uterine disease is the report recently received from Dr. Gauss, of Freiburg summarizing all the cases of myoma and metropathy treated by X ray therapy of which reports had been published prior to January, 1914. The following tabulation of 1395 cases is furnished by Johannes of the Freiburg Frauenklinik. Only such reports were included as gave specific information as to the dosage and technique employed

	Number of the treated cases	Percentage of		
		Cure	Death	Recurrence
Group I (50-175x)	693	72	0.5	4
Group II (175-500x)	544	82	0	3
Group III (500-1500x)	158	95	0	0
Total	1395			

It will be seen that corresponding to the increase of Kienboeck's X units there was an increase in the percentage of cures from 72 per cent to 95 per cent. It should be borne in mind that these cases were all of them studied by gynecologists previous to the beginning of roentgentherapy and the therapeutic effects judged by them, not by the rontgen therapists. The deaths which occurred in the first series could not be, in any way, attributed to the rontgentherapy.

Albers-Schoenberg, who is the father of deep rontgentherapy as applied to gynecology, summarizes his views on this subject. These views have been incorporated with the results of the writer's experience in the following paragraphs:

1. Röntgen deep therapy is based upon the fact that the röntgen ray has a decided deleterious effect upon the male and female glands. The effect on the myomata is primarily through the ovaries, but certainly in the majority of cases there is a direct effect upon the tumor cells themselves, manifested

by decrease in the size of the tumor. The report of Kelly and Burnham on the direct effect of the gamma rays of radium upon myomatous tissue supports this view.

2. The symptoms caused by myomata improve and are sometimes entirely overcome. The hemorrhage may be changed into the normal menstrual type or a complete cessation may be brought about.

3. The general conditions improve and the symptoms of the menopause are generally mild. In suitable cases the percentage of complete recoveries is high, yet it must be admitted that a certain number of myomata are refractory.

4. A certain percentage of myomata now, as before, must be operated upon. Not all are suited for röntgen treatment.

5. There is some danger of the appearance in the skin of injuries which are not manifest until some time after the cessation of the treatment. The future will show just how much they are to be feared. At the present time we are justified in believing that the late appearance of injury to the skin cannot occur unless the skin has suffered from a röntgen dermatitis of the first degree. It is essential that heavy dosage be applied yet with careful observance of all the conditions necessary for the administration of deep röntgentherapy as much as twenty x units under the filter may be given as a routine without producing a röntgen dermatitis. As many as six or eight series of treatments, each receiving 20 x, may be given each three or four weeks without producing any noticeable skin effects, not even atrophy of the skin. The writer would warn against larger doses except in cancer cases.

The indications and contra indications for treatment have been fully stated by Pfahler in the *Journal of the American Medical Association*, August 22, 1914. We may summarize as the chief indications for deep rontgentherapy in gynecology the treatment of climacteric and other known benign hemorrhages in older women, in whom the anatomical character of the endometrium should be ascertained by microscopical examination before rontgentherapy is decided upon.

It has also been urged as a contra indication to deep rontgentherapy that, should the rontgen treatment fail and operation subsequently be decided upon, the intensive irradiation will have stimulated the formation of multiple adhesions which will interfere seriously with the operation. In fact, one prominent gynecologist, in confirmation of this argument, cited a case in which, following intensive irradiation in a case of uterine hemorrhage, it was finally deemed necessary

to operate. At laparotomy the pelvic organs were found matted together by multiple adhesions which the operating surgeon attributed to röntgentherapy. The writer doubts very much the *post hoc propter hoc* nature of this argument, but he has not, until recently, had an opportunity to contradict it definitely. It seems, however, that the following case controverts any such argument that may be advanced:

The patient, F. C., age 62, was first referred for treatment on April 10, 1914, by Dr. W. F. Martin. Mr. C. had an extensive carcinomatous involvement of the prostate with 20 ounces of residual urine. By reason of carcinomatous extension to the bowel, it was not deemed feasible to operate. This opinion was concurred in by Dr. E. Wyllys Andrews, whom the patient later consulted, and palliative treatment was advised. Accordingly röntgen treatments were begun very much after the plan followed in treating uterine myoma, except that the doses were made heavier—twenty five and sometimes thirty X units being given over the various skin areas chosen for cross fire, the carcinomatous area being approached through twenty six areas, twelve anterior, twelve posterior, and two perineal. Only palliative results were hoped for but the results were awaited with great interest. The residual urine was reduced to 2 ounces within four weeks and the prostate was considerably diminished in size.

On February 18, 1915, ten months after treatment was begun the patient meanwhile having received nine series of X ray treatments, the constriction of the bowel by the malignant growth or its cicatrix seemed to demand colostomy. Therefore Dr. Kellogg decided to operate the opportunity being utilized to explore the pelvis carefully. In view of the fact that the patient had been subjected to such an extensive course of X ray therapeutics nearly 6,000 X units measured under the filter having been administered during ten months, the appearance of the intestine was noted with great interest, to discover possible adhesions the result of the röntgenization. The small bowel was entirely free from adhesions. The iliac colon was adherent near the ileocecal junction but in a manner very commonly seen at operation in patients who have never taken any röntgen treatment. Just below the pelvicureteral junction the bowel was found tightly adherent; the adhesions being confined to an area not larger than a pigeon's egg accurately concealing with the size of the carcinoma. Proctoscopic examination of the adherent area showed an annular constriction with some ulceration of the mucosa which did easily on being touched. A colostomy was performed in the usual manner.

The foregoing case, it seems to the writer, proves conclusively that there is no danger of

adhesions following intensive röntgentherapy directed toward the pelvis.

Prostatic hypertrophy. Gradually accumulating experience seems to show that the field of usefulness in deep röntgentherapy will include a certain number of cases of prostatic hypertrophy. The writer does not care to urge this form of treatment for any case where surgery can be carried out, but deep röntgenization may be recommended as a partial substitute for surgery in cases where surgical interference is inadvisable. In general, the technique is the same as that employed in the treatment of uterine myoma. Both anterior and posterior areas should be employed and several perineal areas. In the latter areas a somewhat smaller dosage should be administered because of the greater radiosensitivity of the skin in these parts. The sensitive scrotum, if desired, may be protected from the effect of the ray for there is probably no particular advantage from the irradiation of the testicles. The writer has seen the amount of residual urine diminished from 16 to 2 ounces within four weeks.

The treatment of these cases should be pursued energetically but with the greatest care, and should be conducted for a sufficiently long time to insure a permanent reduction in the size of the gland. It is difficult to speak with certainty on account of the lack of reported cases but certainly here is a field for the further development of deep röntgentherapy. As in the case of uterine fibroids it is of course important that a correct diagnosis be made before beginning the röntgen treatment.

Tuberculous conditions. In practically all forms of tuberculosis röntgentherapy has been tried out. Until within the last two years the verdict was almost unanimous that, in glandular and skin tuberculosis röntgentherapy was reliable in the production of good results, in bone and joint tuberculosis the results were unsatisfactory and questionable, and that in peritoneal, pulmonary, and urinary tract tuberculosis there were no results to warrant the recommendation of this method of treatment.

Recent work by Kuepfert in de la Camp's

clinic in Freiburg has required us to revise our decision concerning the use of röntgen-therapy in *pulmonary tuberculosis*. Gibson of Denver was one of the first to report good results in pulmonary tuberculosis, but he claimed such a high percentage of favorable results without making any very definite statements as to the actual results secured or the technique employed that no great confidence was inspired in his statements. Nevertheless, the experimental work of Kuepferle¹ on animal tuberculosis and his recent report of forty-four cases in man causes us to reconsider the claims of Gibson.

Several investigators, including Leonard, Pancoast, and others, have called attention to the fact that in cases which are described as tuberculous cervical adenitis, röntgenization of the cervical glands has caused a disappearance of the apical signs of tuberculosis. Pancoast however, issued a warning that in cases of mixed infection röntgenization might do harm rather than good.

Kuepferle's experiments are of extreme interest, especially his observation that recent and developing tuberculous foci as well as old caseous processes of not too long standing, could be favorably influenced in the animal experiments. This is of special importance in considering the effect on human beings, where it is well known that fresh foci caused by reinfection occur alongside the older foci. The characteristic thing about all tuberculous lungs treated by röntgen rays is the lack of specific tubercular proliferation tissue and the great richness in young connective tissue as seen in the microscopic studies. The connective tissue not only replaces the granulation tissue but penetrates the caseous and necrotic foci and surrounds them, so that there is a well-marked line of demarcation between the tuberculous foci and the normal lung tissue.

In the lungs of control animals not subjected to röntgenotherapy there were always more or less well-developed caseous foci surrounded by luxuriantly proliferating granulation tissue while no connective-tissue development could be seen. It seems reasonable to conclude from such experimental results that

in proper doses the röntgen rays destroy tuberculous granulation tissue and act as a stimulant to the development of young connective tissue. On the one hand the pathological granulation tissue caused by the infection is destroyed and on the other hand connective-tissue healing is powerfully stimulated. The tubercle bacillus itself is hardly influenced directly, as is shown by positive results of inoculation of the tissues of röntgenized animals into guinea pigs. It was noted, however, that less severe symptoms were caused by intraperitoneal injection of material from röntgenized tuberculous lungs than from tuberculous lungs which had not been treated.

Kuepferle reports on forty-four patients in different stages and with different forms of the disease. At first the patients were not selected, far-advanced and hopeless cases being included in order to best determine the effect on far advanced processes. The forty-four cases were divided into three groups. In the first group there were nineteen cases in which there were active processes with febrile and subfebrile temperature. Seven of these, in addition to the pulmonary infection, had marked enlargement of the cervical and bronchopulmonary glands. In these patients not only the diseased part of the lung but also the lymph glands were treated. In all there was a retrogression in clinical symptoms, decrease in cough and expectoration, and gradual decline in fever. The average duration of treatment was thirteen weeks. Some of the stubborn cases showed a recurrent rise of temperature. All such were given several series of treatments at long intervals until there was complete disappearance of the fever and retrogression of the symptoms. Four patients have been examined from nine to eleven months following treatment and have been found well and free from symptoms.

In the second group were included fourteen cases, some with disseminated and some with confluent foci. All of these were also favorably affected. Of the fourteen, ten are clinically cured and dismissed from treatment. The four remaining are yet under treatment. The longest series of treatments extended over

¹ Kuepferle, L. *Strahlentherapie* 1925 v. No. 7

thirty-two weeks, the patient having a recurrence of fever. This patient was able to work at the time of discharge.

Eleven patients were included in the third group. Five of the eleven were complicated by tubercular disease of the larynx or peritoneum. In all the process was extensive and in some cavitation had taken place to a marked degree. These patients showed only temporary improvement. In general, they were very much more sensitive to the effect of the rays than the patients with incipient disease.

Although final judgment is withheld, the results thus far secured are very encouraging and emphasize the fact that in this day of advanced technique, improved tubes, and better apparatus, too much reliance should not be placed upon the negative results of the older methods of roentgenotherapy.

Cases best suited for treatment are those in the earlier stages of the disease with slight signs of disintegration, even though there may be slight rise of temperature. The advanced cases are ameliorated, but the improvements are not proportionately marked. Surely the good results thus far secured warrant further trial of this method.

In the treatment Kuepferle emphasizes that the laws of deep roentgenization must be followed. Homogenous rays must be secured, and fortunately the modern improvements in technique make this possible. Heavy filtration, relatively short focus-skin distance, and multiple field irradiation are other features of the technique. In severe cases from 15 to 20 X over one or two fields is the maximum daily dosage.

In *skin tuberculosis* the results of roentgenotherapy are very satisfactory. Details as to results of superficial lesions are out of place in this paper.

In *glandular tuberculosis*, the results of different investigators vary, but Crane's investigations suggest that the investigators with poor results have failed to observe the principles which should govern the treatment of such cases.

In some experimental work comparing the *opsonic index* following vaccine injections with the *opsonic index* following X-ray treat-

ments, Dr. Crane was able to show that the *opsonic curve* was essentially the same under both conditions. This indicates that the interval between X-ray treatments should be the same as the interval between vaccine injections, and that if the X-ray treatments are too severe or over too large an area, the reaction would be the same as if too large an injection of vaccine had been given. In this way a negative phase could be produced from which the patient might not be able to recover.

Dr. Crane concluded that the duration of exposure and the extent of the diseased tissue exposed should be so regulated as to produce either a small negative phase or none at all. The repetition of exposure should, as far as possible, be governed by the duration of the negative and positive phases. It follows as a corollary that it is not necessary to expose the whole area in order to bring about complete recovery. Dr. Crane believes that, as a rule, exposures should not be repeated oftener than twice a week, and probably in most cases at less frequent intervals, to secure the maximum results and to avoid prolonged or incurable negative phases. The writer urges careful consideration of Dr. Crane's investigations concerning the treatment of this disease.

The results in *bone and joint tuberculosis* probably depend upon the same principles which govern the treatment in glandular tuberculosis, as just stated. American roentgenologists have not reported the good results which have been claimed by many French and German workers in the treatment of these conditions, but in view of the scientific standing of the men whose work is attended by success, further effort in bone and joint conditions seems indicated.

We still record negative results in the treatment of *tuberculosis of the urinary tract* and in *tuberculous peritonitis*, the number of favorably affected cases being still too small to warrant any definite conclusions.

In the foregoing pages the writer has sought, not only to emphasize the usefulness of deep roentgen irradiation in certain conditions where the value of this remedial agent has already been acknowledged, but also to

point out a number of fields in which, theoretically at least, this agent would be of value, but where up to the present time sufficient clinical evidence has not been accumulated under the conditions of accuracy which should attend the present-day employment of deep roentgenotherapy. Emphasis has been laid upon the necessity of accuracy in dosage, skill in manipulation of instruments, filters, and lead protection, and judgment as to the dosage indicated. As already intimated, the ownership of a roentgen installation by no means signifies skill in its use. All roentgen treatments should be recorded in such terms that any roentgen worker will understand the exact dosage and be able to duplicate the treatment.

There is, at the present moment, no organized literature on the subject of deep roentgenotherapy as a whole. Numerous papers have appeared on the various phases of treatment, particularly those phases relating to gynecology, but what the writer would like to urge very emphatically is that in view of the renewed possibilities from this method of treatment, no case in which roentgenotherapy is theoretically indicated should be denied a trial of this measure merely because the literature reports unfavorable results. In other words, much of the literature of deep roentgenotherapy must be rewritten and the writer ventures the opinion that many of the conclusions will be changed in the revision.

DISINFECTION OF THE HANDS AND ABDOMINAL SKIN BEFORE OPERATION

By ELLICE McDONALD, M.D., New York

DISINFECTION of the hands is one of the most important subjects in surgery. It is necessary to cleanse the hands before every operation in order to prevent the possibility of infection. The most commonly used substances heretofore used for this purpose were alcohol and the mercury salts.

Alcohol is a weak germicide, and its value depends more upon its cleansing properties than upon its actual germicidal powers. Koch grew spores after 110 days in alcohol. Goenner grew streptococcus after fifteen minutes in alcohol, and Senger, staphylococcus aureus after twenty minutes. My own experiments have shown the germicidal strength of alcohol to be of no great value; cultures of staphylococcus aureus have not been killed upon the hands by 90 per cent alcohol in five minutes. Tjaden states as a result of his experiments, and from a review of the work of Epstein, Ahlfeld, Saul, Paten, Fürbringer, Reinicke, and Kronig, that this is the most efficient percentage of alcohol. However, I believe that the germicidal action

of alcohol is so slight that consideration of the percentage is of no great consequence. A proof of this is the large percentage of alcohol which is required, acting even as an antiseptic, to prevent decomposition in various proprietary liquid foods and medicines. The virtue of alcohol in cleansing the hands is exerted more as a chemical solvent than as a germicide. Alcohol, although a solvent of free fatty acid, will not dissolve the fat as found in the skin, i.e., the glyceride. The ideal skin disinfectant should be a fat solvent.

According to the experiments of Minervine, it took two minutes for 70 per cent alcohol to kill the staphylococci, while the same organism survived in 3 days' exposure in 99 per cent.

Harrington and Walker, in their useful article, came to the following conclusion.

"Against dry bacteria, absolute alcohol and ordinary commercial alcohol are wholly devoid of bactericidal power, even with twenty-four hours' direct contact, and other preparations of alcohol containing more than 70 per cent by volume are weak in this regard, accord-

ing to their content of alcohol—the stronger in alcohol the weaker in action.

"The most effective dilutions of alcohol against the strongly resistant (non-sporing) bacteria, such as the pus organisms, in the dry state, are those containing from 60 to 70 per cent by volume, which strengths are equally efficient against the same organisms in a moist condition.

"The stronger preparations of alcohol possess no advantage over 60 to 70 per cent preparations, even when the bacteria are moist; therefore, and since they are inert against dry bacteria, they should not be employed at all as a means of securing an aseptic condition of the skin."

Bichloride of mercury is the most widely used substance in skin disinfection. This salt, while a powerful germicide under test-tube conditions, is rendered inert by organic matter, such as pus, serum, blood, soap, skin, mucous membrane, albuminous fluids, etc. The insoluble albuminate of mercury is formed, and the salt neutralized, after which there is no germicidal action. The use of this salt is illusory and deceptive and, as a skin disinfectant, its results are inconstant and uncertain. Bacteriological control of bichloride hand disinfection may give negative results, because the antiseptic or inhibiting action is great, so that cultures taken do not grow because of the surplus sublimate, or, if the salt is neutralized, the neutralizing agent may itself inhibit growth.

For this reason, negative results of cultures after disinfection with mercuric chloride are of little value. However, positive results of growth of bacteria from the skin after treatment with mercuric chloride are very frequently reported. Geppert, for example, grew cultures after a fifteen-minute application of 1:1000 mercuric chloride. Aperló found that 2 per cent bichloride of mercury solution had no effect upon the number of germs on the hands when the antiseptic or inhibiting action was eliminated, and Fowler showed that bichloride lost its efficiency in the presence of pus. Further adverse reports could be cited indefinitely.

The other mercury salts are equally impracticable. Harrington of Boston, for ex-

ample, examined mercuric cyanide and found that 1:500 solution had no effect upon staphylococcus aureus up to half an hour, beyond which time the experiments were not continued.

Iodine solutions are also impracticable for hand disinfection because of the irritation to the skin which they cause. Alcoholic solutions of iodine give only superficial disinfection, while with solutions of iodine in fat solvents, such as carbon tetrachloride or acetone, there is complete penetration of the entire cutis, as has been shown by my own carbon tetrachloride 2 per cent iodine solution. Loiacono, who studied the subject thoroughly, concluded that tincture of iodine would not kill organisms while on the skin, and that disinfection of the normal skin by tincture of iodine was impossible. Robb came to a similar conclusion that tincture of iodine was not to be relied upon, and that, after the removal of the iodine from the skin, organisms were frequently found.

Potassium permanganate and oxalic acid have the objection that their effect is diminished by organic matter, such as soap, skin, albuminoids, serum, pus, blood, etc. The same is true of formalin, which has a carbollic acid coefficient of only 0.3, so weak as to be negligible for disinfection of any kind.

Mechanical washing has but little effect upon the presence of bacteria on the hands. In this study they were always found after five minutes scrubbing with soap and water. This is not surprising, as soap has no germicidal value. Aperló concluded that continued washing up to one hour had no effect upon the presence of skin bacteria. Five minutes satisfied me, as beyond that time the irritation to the skin was so great as to exclude this method on practical grounds.

The experiments of Schumburg showed that, when the old method of cleansing the hands by scrubbing with soap and water was used, the hands often showed more bacteria after scrubbing than before, and that washing the hands with a nailbrush and soap and hot sterilized water, even if carried out energetically for twenty minutes, does not remove the microbes which adhere to the skin. Soap appears to soften the skin as well as the

capsules of the bacteria, so that the latter adhere with unusual tenacity. He ascribes the lack of success of the scrubbing to the bringing of bacteria from the gland crypts to the surface. He showed that the subsequent scrubbing in bichloride solution did no good and only roughened the skin.

Van Brunn, in his experiments, found that preliminary washing with soap and water was undesirable and claimed that it interfered with subsequent disinfective action because of the swelling of the tissues of the skin, destruction of the skin ducts and hair follicles, and hydration of the tissue.

The ideal skin germicide should perform its work quickly and without irritation to the skin. It must be a fat solvent in order that the fatty content of the skin may be dissolved away and the germicide penetrate into the interstices, hair follicles, and sweat glands. More bacteria are in the hair follicles than elsewhere. No irritation should be caused for, with continued use, irritation means inflammation and infection of the skin, rendering further disinfection difficult. The germicidal solution should be cheap and easily made. Last of all, it must be efficient and sterilize the skin within five minutes, as beyond that too much time is occupied in the process. If a method of disinfection is difficult and tedious, surgeons and assistants will unconsciously shorten the time. When a patient is ready, under ether it is difficult even for the most self-controlled not to unconsciously hasten the time of immersion in the germicidal solution. For these reasons five minutes is the longest period allowable for the ideal skin germicide.

In making experiments in hand disinfection certain precautions should be taken in order to have a true and honest result. The hands should be infected or contaminated before each experiment with a twenty-four-hour culture of one of the pus-forming organisms, preferably *staphylococcus aureus*. This culture should, in each case, be allowed to dry into the skin and penetrate by rubbing into every crevice. Cultures older than twenty-four hours have a reduced resistance, which may amount to one third of the normal resistance of a young, vigorous culture.

Hence the need of standardizing the resistance of the culture.

After the germicidal solution has been applied, all antiseptic action, inhibiting culture growth, must be eliminated or removed, either by washing or by neutralization. The wash or rinsing water should also be tested by plating to find whether any inhibiting action remains after inoculation with some of the culture. Streak cultures on agar plates give more exact results than do shake cultures, and less outside or accidental contamination, although both methods should be used. The scrapings, taken from the hands, should be obtained by a knife, exerting firm pressure in order to get as much of the superficial skin as possible, and scrapings should also be taken from under the nails.

A review of a great number of papers upon hand disinfection did not reveal one in which all these precautions were taken. The present study was conducted according to these requirements, and, in addition, a control of the infected hand was made on each occasion in order to show that a vigorous culture was used. The hands were bathed and rubbed in twenty-four hour *staphylococcus aureus* broth culture. *Bacillus prodigiosus* was also used. The culture was allowed to dry upon the skin. A control plate was made from the scrapings before disinfection, and invariably showed from 20,000 colonies to profuse overgrowth impossible to estimate. The hands were then immersed in the solution, one hand only in each vessel, in order that there might be no marked mechanical action to mask the result. The hand was then removed and the excess of solution allowed to drain off from the skin. The hand was then thoroughly rinsed in sterile water until all traces of the germicide were removed. Five ccm of culture were added to each litre of the first rinsing water, and 1 ccm plated to show that there was no inhibitive action. Scrapings were then taken by firm pressure from the skin and beneath the nails, and plated on agar.

During a period of ten years many hundred solutions and germicides have been tried and compared one with another as to results. This comparison was obtained by shortening

the period of immersion to 15 and 30 seconds in order to find the breaking point of the solution. My final solution had the following composition:

Acetone ¹ (commercial)	40 parts
Denatured alcohol . . .	40 parts
Pyxol . . .	2 parts

With this solution, in no case was any growth obtained after 30 seconds' immersion. This period, however, is too short in practice, and one minute is advised to provide a margin of safety. Preliminary washing with soap and water was found to be no aid to efficiency, but was rather a slight hindrance. It had no additional disadvantage of irritating the hands. No growth was obtained in a number of experiments when the hands were simply sponged with the solution (one-half inch deep) for one minute and not immersed. This sponging was considered only as an emergency method in case of great haste and scarcity of solution.

The method advised is to treat the hands in the germicidal solution in a vessel sufficiently large to admit the hands and rub with a nail-brush for the nails, and a gauze cloth for the arms, to aid the solution in permeating every crevice. As has been said, the experiments were conducted with very little or no mechanical friction or rubbing, in order to make doubly sure of the value of the final solution; but, in practice, this is recommended as an additional precaution.

In order to eliminate, as much as possible, the personal equation, all cultures from the hands were controlled by Dr Frederic Sondern, who confirmed the results in all particulars.

This solution has the following advantages:

It is reasonably cheap. It does not irritate the skin, as I have proved by many thousand immersions of my hands and arms. It contains a fat solvent, acetone, which causes the solution to penetrate. The alcohol is a good vehicle. It contains a strong germicide, twenty times as germicidal as carbolic acid in equal strengths, and this germicidal value is not impaired by the alcohol or acetone. This was proved by taking the coefficient of

the pyxol after it was in solution in alcohol and acetone.

The solution thus has the germicidal value of phenol in 40 per cent solution (if such a solution could be made), plus the germicidal action of the solvent. Pyxol is a dark liquid, extracted from coal-tar creosote, which forms a white emulsion with water, and a light mahogany-colored solution with alcohol and acetone. Its germicidal efficiency is twenty times that of phenol. The action of pyxol is not impaired by pus, soap, serum, and other albuminous matter. Pyxol is said to have the following composition: 40 per cent pyxol oil, 30 per cent neutral hydrocarbon oil, and 30 per cent saponified vegetable oil. It is said to be free from carbolic and cresylic acid. The neutral vegetable oils are present only as emulsifying agents.

In conclusion, it is to be advised that the hands be disinfected before operation by immersion in this solution for one minute with the aid of a nail brush and a gauze cloth. By this means more complete disinfection may be obtained than by any of the known methods. The solution is inexpensive, unirritating to the skin, and efficient. It may be used repeatedly. It will acquire a sediment of various detritus which in no way impairs its efficiency.

I wish to thank Dr Frederic Sondern for his care and usual thoroughness in the final bacteriological work in controlling my results, which were first worked out in my own laboratory. His report is appended and shows that the period of immersion was seldom extended beyond half a minute, although one minute's application is advised in order to provide a margin of safety.

This solution has been used by me for the sterilization of the hands and the sterilization of the skin of the abdomen before operation for more than a year with uniformly satisfactory results. In the sterilization of the skin of the abdomen, it is rubbed on for two minutes before operation after the patient is under ether without any preliminary washing. It speedily evaporates from the skin.

Since using this solution, I have had better wounds with more perfect healing than ever

¹ Acetone may be best obtained from dealers in painters' supplies. It is used by them as a varnish remover. It need not be chemical pure.

before, and the same report has come to me from other surgeons who have used it in their practices for sterilizing the abdominal skin.

Since it is possible to sterilize the hands so thoroughly and in such a quick and easy fashion, it does not seem to be any further advantage in using rubber gloves, for the hands can be resterilized after contamination in less time than it takes to remove the contaminating gloves and put on a clean pair. Since I have been convinced of the efficacy of this method of sterilization of the skin of the hands, I have not used gloves while operating. I have, however, fortified my skin by means of a hand varnish which is very easily applied and which I have described in another journal.¹

LABORATORY REPORT

BY FREDERIC E. SONDER, M.D.

TESTS OF EFFICIENCY OF FLUIDS FOR HAND DISINFECTION

Report No. 50,755 October 27, 1913

Technique The hands were bathed in staphylococcus aureus 24 hour broth culture, and the culture allowed to dry in. On removal from fluid the hands were well rinsed in sterile water and scrapings taken by firm pressure with a knife from the palm and fingers. An agar plate was made. This technique was repeated for each experiment.

Solution B =

Alcohol	60 parts
Acetone	40 parts
Pyxol	2 parts

Plate No. 4 Unwashed hands in solution B for 30 seconds, no growth

Plate No. 6 Unwashed hands in solution B for 1 minute, no growth

Plate No. 8 Unwashed hands, nail scrapings, in solution B for 2 minutes, no growth

Report No. 50,809 October 29, 1913

Plate No. 2 Hands washed in water and soap 5 minutes with addition of 1 minute in solution B, no growth

Plate No. 4 No washing, 15 seconds in solution B, no growth

Plate No. 6 No washing, 30 seconds in solution B, no growth

Plate No. 8 No washing, 30 seconds in solution B, no growth

Report No. 50,934 November 3, 1913

Hands infected with bacillus prodigiosus, no preliminary washing before treatment.

Plate No. 1 30 seconds in solution B, one contaminating colony, no prodigiosus

Plate No. 2 30 seconds in solution B, no growth

Plate No. 3 30 seconds in solution B, no growth

Plate No. 4 30 seconds in solution B, no growth

Plate No. 5 30 seconds in solution B, no growth

Hands infected as above, then rinsed and sweated in rubber gloves for 15 minutes

Plate No. 6 2 minutes in solution B, no growth

Plate No. 7 2 minutes in solution B; one contaminating colony, no prodigiosus

Hands infected as above; no preliminary washing before treatment.

Plate No. 9 15 seconds in solution B, one colony staphylococcus albus, no prodigiosus

Plate No. 11 30 seconds in solution B; no growth

Plate No. 12 15 seconds in solution B after preliminary soap and water scrubbing 5 minutes, no growth

Plate No. 13 15 seconds in solution B after preliminary soap and water scrubbing 5 minutes, no growth

Plate No. 14 Sponging in 10 ounces solution B, 1 minute (fluid in basin only $\frac{3}{4}$ inch deep); no growth

Plate No. 15 Sponging in 10 ounces solution B, 1 minute (fluid in basin only $\frac{3}{4}$ inch deep), no growth

Note—In certain coal tar creosotes there is a highly germicidal substance which is used as the essential germicide in three different preparations. It has never, to my knowledge, been isolated in pure form as yet, and its composition is unknown. It is present in the germicide used here in an impure form, and it is hoped that it will be eventually isolated.

The germicide here used and the solutions I have devised should be used with caution upon the mucous membrane and on raw surfaces. It is irritating to them, although not irritating to the unbroken skin.

Contaminating colonies in Nos. 1 and 7 on edge of plate and obviously technical error of dust

¹ Ellice McDonald. A new skin varnish and substitute for rubber gloves. Med. Rec., 1911, March 17

REPORT ON SKIN DISINFECTION BY McDONALD'S SOLUTION

By C. G. McMULLEN, M.D., F.A.C.S., SCHENECTADY, NEW YORK
Gynecologist to the Ellis Hospital

THE prevention of infection has always been the endeavor of surgeons, and complete elimination of bacterial infection is their ideal. Many and various are the methods which have been devised of this nature, and great are the improvements that have been made. Sterilization of dressings and instruments by heat is one of the greatest advances, and the chief remaining source of infection which may possibly be avoided is contamination from the abdominal skin and the surgeon's hands.

Rubber gloves have been a great improvement, although in the last few years there has been a tendency to cast some doubt upon their complete efficiency. Gloves are frequently torn or pricked by needles to liberate bacteria suspended in the perspiration of the hand. Unless the hand is sterile when inserted into the rubber glove, the moisture and perspiration from the hand will collect within the rubber and very soon be contaminated by the bacteria of the skin. Hellendall and Fromme¹ found that in 46 of 90 operations the gloves of the surgeons after operation contained liquid sometimes to the amount of several cubic centimeters. This liquid, as was shown by cultures, contained two, three, and even ten times the number of organisms recoverable from the hand before the glove was put on, and in some cases more than before the hand was treated. Putting on gloves dry did not alter the result. This is a commentary upon the danger of glove punctures and the inefficiency of former methods of hand disinfection.

Gloves themselves are difficult to sterilize and require fifteen minutes in boiling water, or one hour in the steam sterilizer with fifteen pounds' pressure. Braun² found that, when tightly wrapped, gloves require one hour's steam sterilization, three-quarters of an hour did not suffice unless the gloves were loosely wrapped and the fingers distended by cotton

His results were controlled bacteriologically. He favors placing cotton gloves inside the rubber in order that the steam may penetrate. For this reason it is best that if gloves are used they should be boiled and not sterilized in a steam sterilizer.

An example of the pessimism which exists in regard to skin disinfection is shown by bacteriological tests of Hecht and Koehler,³ who state that ideal asepsis of the hand does not exist, and that all methods heretofore devised effected at most a diminution of the number of bacteria or a reduction of those liberated, but never a sterile condition of the hand. They stated that tincture of iodine is not germicidal, but tans the skin and that the sterilized rubber gloves furnish an aseptic covering to the hand at the beginning of operation only. Aperlo,⁴ in a study of disinfection of the hands, came to the conclusion that continued washing with warm water and soap and using a sterile nail-brush was not sufficient to remove the germs from the skin and that the result, was no better if the washing was continued for one hour. Washing the hands with a 2 per cent bichloride of mercury solution had no effect upon the number of germs on the skin. It is very easy to contaminate a boiled rubber glove when putting it on by touching the outside with the imperfectly sterilized skin of the hand.

There is no doubt that, heretofore, abdominal operations have usually been done through skin that was imperfectly sterilized. Steinegger⁵ studied the bacteriology of the treated skin by making cultures with the knife which was used to make the skin incision. The skin was disinfected by the methods in common use at present—alcohol, iodine solutions, etc. In 347 observations in cultures obtained from the knife, in 72 instances, and it is probable that in a number of

¹ Hellendall and Fromme. *Zentralbl. f. Gynäk.* 1912, November 30.

² Braun. *Beitr. z. klin. Chir.* 1908, lxxviii, 3.

³ Hecht and Koehler. *Wien. med. Wochenschr.*, 1911, x.

⁴ Aperlo. *Klin. Chir.*, 1913, xxi, 322.

⁵ Steinegger. *Zeitschr. f. Chir.* 1913, May.

cases in which no growth was obtained, the bacteriological growth was due to the inhibition from the antiseptic action of the solution used in disinfecting the skin. The majority of these cases were treated by iodine skin disinfection.

Being dissatisfied with my methods of sterilization of the abdominal skin and hands before operation, I was interested in the investigations of Dr. Ellice McDonald upon the various methods of skin disinfection. In June, 1914, I began using his solution. Previous to this time I had used iodine skin disinfection. McDonald's solution is as follows:

Acetone, commercial	40 parts
Denatured alcohol	60 parts
Pyxol	2 parts

The field of operation was prepared, if possible, on the evening before the operation, by shaving and washing with green soap, water, and alcohol. It was covered with a dry sterile towel and left until the next day. At operation, the site was treated by rubbing with McDonald's solution for about two minutes. The hands of the assistants and operator were prepared by scrubbing with soap, water, and alcohol, followed by two minutes' treatment with McDonald's solution.

Over a period of eight months I operated upon 276 major cases which had been prepared after this method. They were practically all laparotomies or hernias. In emergency cases the soap and water scrubbing of the operative field was dispensed with and only McDonald's solution used. In this series of cases there were seven skin infections, a percentage of 2.54 per cent. These cases were as follows:

1. Clean appendectomy, which had a very slight or mild skin infection.
2. Inguinal hernia. The infection was found sixteen days after operation and the pulse and temperature were normal in the meantime. The infection was apparently due to some irritation from the kangaroo tendon suture.
3. Abdominal hysterectomy. Skin infection.
4. Bilateral purulent salpingitis. Infection of the space of Retzius occurred and was apparently due to spreading of the infection from the pus tubes themselves.
5. Cesarean section. A skin infection. This was a contaminated case, as the cervix had been packed with gauze 48 hours before operation.

6 and 7. Clean laparotomies. These were done at the Mercy Hospital on the same day, and it was subsequently demonstrated that several of the operating room nurses were suffering from sore throats. The organism in the wound infection was identical with the organism cultivated from the throats of the nurses. The wounds in the service of other surgeons suffered in the same way.

Excluding those cases in which infection was obviously due to some extraneous causes, there remain but three cases in which there was any skin infection, which might be attributed to improper disinfection of the skin. It is, however, a well-known fact that in both hernias and abdominal hysterectomies infection is more frequent than in other clean cases, so that these three cases can hardly be charged against McDonald's method of skin disinfection.

From this analysis of my experience with this solution I believe it to be the most efficient method of skin disinfection at our disposal at the present time. Healing, under its use, seems to take place more readily than under the iodine skin disinfection. Previous to this solution, tincture of iodine was used over a period of a number of years and since the change in method there has been noted a definite change in the manner of healing. Wound repair is accelerated by at least three days, that is to say, wounds in skin treated by McDonald's solution and dressed upon the tenth day have the appearance of wounds three days older under the iodine skin disinfection. I consider that the new solution very decidedly reduces the risks of contamination and infection of the wound from skin organisms. Applied to the hand, it is unirritating and is almost ideal as a skin disinfectant.

NOTE.—Being so well satisfied that this method of skin disinfection eliminates bacterial contamination from the hands of the operator I have been encouraged to use McDonald's skin varnish and substitute for rubber gloves (McDonald, *Medical Record*, 1914, March 25). My assistants wore rubber gloves and I myself used the skin varnish and had very satisfactory results. During the cold weather, however, I found that the acetone used in its removal caused a little irritation of the skin. However, it has been suggested to me that this might be obviated by using the germicidal solution to remove the skin varnish. I intend to return to the use of the skin varnish instead of rubber gloves for the increased tactile perception is a very great help in operating on deep-seated abdominal lesions.

STERILIZATION OF THE SKIN BY A MORE POWERFUL AND LESS IRRITATING GERMICIDAL SOLUTION THAN TINCTURE OF IODINE

BY E. MACD. STANTON, M.D., F.A.C.S., SCHENECTADY, NEW YORK

STERILIZATION of the skin is still a subject for debate. Any changes in the technique of skin disinfection must fulfill certain demands. The future method of skin sterilization must not only give better results than are obtained by the iodine method but must be equally rapid and simple in its manner of application. This necessitates reliance upon some germicidal solution, and it is generally conceded that the ideal solution should fulfill the following conditions

It must have a high degree of bactericidal activity. It should be generally applicable on all skin surfaces wet or dry, including the hands of the operator. It must be capable of penetrating the crevices of the skin and dissolving oily substances in the skin to reach buried bacteria. It must be non-irritating and at the same time it should not lower the power of resistance of the tissues, nor by its presence delay the processes of wound repair.

It has been abundantly demonstrated by those who have investigated the question bacteriologically that tincture of iodine is not an ideal germicidal solution for skin disinfection. Under favorable conditions, with direct contact with the bacteria, iodine is a moderately active germicide, but upon the skin, conditions are unfavorable. The penetration of iodine is apparent rather than real, and in several other respects tincture of iodine fails to meet the requirements. Since Grossich¹ demonstrated that results equal to the more complicated methods of skin disinfection could be obtained by painting the dry skin with tincture of iodine, the iodine method in some of its modifications has been adopted by most surgeons here and abroad. However, experiments of Robb² showed that, when the inhibitive power of the excess of iodine had been removed by washing

with 10 per cent potassium iodide, bacteria were almost constantly recovered in culture after tincture of iodine disinfection. The effect of the inhibiting power of tincture of iodine is shown in the fact that when this precaution is not taken in making cultures, the cultures were sterile in 86 per cent of the cases, but when the excess was neutralized by potassium iodide solution, organisms were very frequently found. He concluded that sterilization with tincture of iodine is not efficient and should be used only when more elaborate forms of disinfection are contra-indicated. Similar results have been reported by Loiacono,³ Tinker and Prince,⁴ and others. A dry field is essential to its success. This was amply demonstrated by Grossich, Walther, and Touraine,⁵ and many others and necessitates either washing and shaving the field some hours before the operation, or a dry shave, the irritation of which every man knows. Furthermore, tincture of iodine is too irritating to be a hand disinfectant, and thus is not universally applicable in the operating room. Heusner⁶ added a fat solvent in his 1:1000 iodine-benzine solution, but this merely complicates the treatment and this iodine-benzine solution may blister dependent or moist surfaces.

The use of tincture of iodine as a therapeutic irritant long preceded its use as a germicide, and while the irritation produced does not condemn it as a skin disinfectant, it is nevertheless a disadvantage. The possibility of the iodine used on the skin coming in contact with exposed peritoneal surfaces and causing troublesome irritation is recognized by many surgeons, and the field of operation is therefore encumbered and ob-

¹Loiacono. *Gynecol. mod.* 1909, September.

²Tinker, M. B. and Prince, H. L. Common fallacies regard skin disinfection with special reference to the iodine methods. *Burg. Gynec. & Obst.* 1911, xii, 530.

³Walther and Touraine. *Bull. et mém. soc. de chir. Par.* 1909, xxv, 345-394.

⁴Heusner. *Zentralbl. f. Chir.* 1906, September.

¹Grossich. *Zentralbl. f. Chir.* 1903, No. 44, 1356.

²Robb. *Surg., Gynec. & Obst.* 1913, xxv, 321.

secured by protecting pads and towels partially held in place by all sorts of specially devised clamps. Bloodgood¹ has shown that in the presence of bichloride of mercury, iodine may become a very irritating and blistering substance.

- In two and one half years' use of the benzine-iodine tincture-of-iodine method of skin preparation in my own cases, very acceptable results were obtained as to infection, but in about one-fifth of the wounds there was an appearance of delayed healing, due to the chemical effect upon the tissues.

During my interne service at St. Mary's Hospital, Chicago, iodine on a wet surface was usually freely used by all surgeons. The results were good, yet the occasional case which escaped the tincture of iodine healed more rapidly than did the iodine-treated cases. Later, at the Augustana Hospital, I saw large series of operations performed after a simple soap-and-water scrubbing the night before and a rinsing with alcohol immediately before the operation. This simple preparation gave the best results both as regards freedom from infection and rapidity of primary healing, except the recent alcohol-acetone pyxol prepared cases. Later a more elaborate and painstaking preparation showed few skin infections, but caused delay of wound healing, so that a twelve-day wound after the complicated method looked approximately like an eight or nine day soap-and-water alcohol wound. This delay in healing was at once eliminated when the method of preparation was chemically simplified. My conviction is that wounds through iodine-prepared skin surfaces are more ordematous and slower in healing than clean wounds made through skin surfaces prepared with simple soap and water or alcohol scrubbing.

- Since November 1913 I have used Dr. Ellice McDonald's solution as given in his paper.

Alcohol (denatured)
Commercial acetone
Pyxol

60 parts
40 parts
2 parts

The solution is non-irritating, so that it can be regularly employed for disinfecting

the surgeon's hands as well as the patient's skin. Water, up to 10 per cent or more, does not interfere with its action. Hence it is possible to use it on wet skin surfaces such as those recently lathered for shaving, or the operator's hands after he has scrubbed them with soap and water.

The solution is itself an excellent cleansing medium and so harmless that it can be used actually to scrub the patient, whereas tincture of iodine should not be rubbed in. It can be used before the patient is anesthetized without danger of complaint, as it is not irritating. It does not stain skin surfaces and dries very quickly, so that it is not necessary to protect peritoneal surfaces from contact with the skin, as in the case of iodine skin treatment. It is cheaper than tincture of iodine.

During the fifteen months in which I have used this solution I have had only two infections occurring in 240 otherwise clean cases, a record never before equalled in my own work. Both of the infections were studied bacteriologically and traced to their sources. The first one in December, 1913, was one of a group of similar infections occurring in the work of several surgeons in the same hospital, and was definitely traced to an operating room error in catgut preparation. The second one occurred in January, 1915. Three other surgical infections occurred in the same hospital at this time and within two days, and it was found that half the nurses in training had septic sore throats. These infections were apparently due to this cause.

During the year 1914 there was not one drop of pus collected in a clean case operated upon by me. Such results are significant and at least show that the method of skin preparation was efficient. Even more important is the fact that the wound healing was without evidences of chemical irritation, without peeling or blistering of the skin, and quite as rapid as that previously observed in simple alcohol-prepared incisions. In conclusion, I would say that I have never before had such rapid healing free from all evidence of chemical irritation.

¹ Bloodgood. *Progressive Med.*, 1913, 27, 4, 115.

CYSTALGIA; URETHRALGIA

SYNDROME VESICAL AND URETHRAL NEURALGIA

BY LEON JOSEPH ROTH, M D, F A C S, LOS ANGELES

THIS syndrome with its more or less complicated etiology has to a certain degree escaped definite description. The condition is sufficiently often met with to make it a subject of more than passing interest, and the aim of this paper will be toward simplifying its symptomatology and classifying its causes.

The primary division of these cases, as regards the etiology, is into the idiopathic and symptomatic. For the purpose of differential description this latter will be subdivided into—

1. Lesions involving the nervous system
2. Lesions of the urinary tract.
3. Lesions of adjacent structures

1. *Lesions of the nervous system* Of all the diseases included in this category, tabes most prominently presents urinary derangements. In practically all forms of paralysis, retention is the chief urinary symptom. Tabes is not an exception, but it may present apart from this a more or less typical cystalgia. This is sometimes the revealing symptom of a posterior sclerosis. In neither the pre ataxic stage nor in confirmed tabes are the symptoms constant or progressive, they may be attenuated or may disappear entirely in spite of medullary progress, and *vice versa*. The tenesmus accompanies urination, occurs during the evacuation of the last few drops, or may persist for a varying time with total inability to void any urine whatever, it manifests itself at the cervix and along the urethra with irradiations to the rectum.

The "vesical colic" or crisis, as first described by Fournier, are pains of sudden apparition, which extend over the bladder, urethra, and perineum and are atrocious in character. They persist from a few minutes to half an hour and disappear brusquely. During this crisis the desire to urinate is exaggerated, and the act is imperative and irresistible. The patient passes urine with

difficulty and with tearing pains at the bladder neck.

Hysteria is responsible for a train of symptoms of which pain and spasm of the urethra with possible transitory retention are the major manifestations. Very large quantities of low gravity limpid urine are voided and the attack disappears for an indefinite time.

2. *Lesions of the urinary tract* This class includes a majority of the surgical infections of the urinary system. Dilatation upon all these factors will not be attempted, because in the severer surgical complications the vesical symptoms are not classically those of a neuralgia but assume the type of an ordinary cystitis, or of dysuria with severely infected bladders, that is, the "painful cystitis" of Hartmann. The various forms of renal reflexes described by Guyon and others play an important rôle, and it may be assumed that these are the primary causative elements of the vesical pain and that their creation is due to inflammation and obstruction of the upper urinary segment and the production of pelvic retention and distention. The commonest conditions imputable are urinary tumors, movable kidneys, ureteral strictures, and calculi. Occasionally a painful nephritis transmits sensation to the bladder muscle. The ingestion of such drugs as turpentine, cantharides and the balsamics are provocative, the latter particularly causes severe renal colic that may be transmitted downward.

Foreign objects in a non infected or mildly infected bladder have been observed, for instance a button, hairpin, piece of wood, or calculus. The attendant symptoms were dysuria but did not assume the aggravated type of true neuralgia.

3. *Lesions of adjacent structures* Affections of adjacent structures, such as abdominal and pelvic tumors and masses, determine vesical spasm in a certain proportion of cases.

Pressure, adhesions, inflammation, or post-operative nerve inclusions may be invoked as the causative influence. The pregnant uterus is here included. Uterine deviations are frequently the source of cystalgia, particularly the antelexions and versions, while ulcerations and adhesions of the cervix, particularly the latter, add bladder misery to the sufferings of neurotic young women.

The remnants of a prostatitis and vesiculitis, although they be subjectively painless, may, however, give rise to cystalgic symptoms. In plural examinations of these patients who are sexual and urinary neurotics, the fact is noted that the exploring finger will determine exquisite pain upon pressure, but the pain is rarely ever in the same place. The verumontanum is a prolific source of trouble, and very amenable to treatment. A spasmodic prostatic urethra, and, in the more aged, a fibrosis, are conditions that present occasionally. In two cases of prostatic carcinoma the dominant symptoms were sciatic pains and severe cystalgia. Both bladders were infected. In one the pain would disappear for days at a time. In the other the urinations occurred at about two-hour intervals, sometimes painless, but more frequently accompanied by terrific spasm. This case was complicated by large multiple calculi.

In this latter class of cases the fault is pathologic in an anatomophysiology sense, the cervix being rigid or at least its mobility is reduced, and there is no normal descent of this segment accompanying the excursion of the vault; in consequence the bladder reaches its containing limit sooner than it should. Thus the frequency is increased, plus the generation of more or less classical symptoms.

The voluntary continents—that is, the pre-nuptial paragon and the sexual hypochondriac—present similar modified urinary symptoms resulting from the congestion caused by repeated erections. As a rule the posterior urethra is the vulnerable part, and while the urinations may be burning in character and slightly more frequent than normal, they do not attain the strict type of a neuralgia. From time to time a case is seen with these symptoms plus transmitted

pain to the testicles and the Cowperian region.

In male children congenital stricture of the meatus and phimosis are exceptionally included in this description.

Of frequent occurrence are rectal and anal ulcerations and growths. Omission must not be made of hemorrhoids and fecal or gaseous distention of the rectum. Eversion of the anal mucous membrane has produced a most intense cystalgia.

In a general way may be mentioned gonorrhea or other microbic infection of the urinary or genital tracts, and especially gonorrhea of the lower bowel.

One of the most important and most commonly encountered conditions determining bladder spasm is an atresia of the female urethra and vagina. It is either of hysterical origin, or, oftener, is produced by senile sclerosis and atrophy of the respective sphincters with the attendant changes in the mucous membranes.

To recapitulate, the actual conditions existing in the majority of cases are of pelvic or contiguous origin, and of these the reduction into vesical, urethral, vaginal and rectal subdivisions greatly simplifies the classification and produces a substantial working basis.

Idiopathic. The more experience I have the more I am convinced that idiopathic conditions do not obtain and that by careful examination some lesion in the urogenital apparatus or anorectal structures will be found. My belief is that where no lesions can be found after thorough investigation a pre-existing trouble has healed spontaneously or has been cured, and that the remnant is a neurosis dependent upon the impression received by the pelvic or genital nerves, the intricate association of the motor, sensory, and sympathetic filaments being so well known that here further dilution is unnecessary.

A word on the physiology and psychology of urination. Normal urination is accomplished by the action of two diametrically opposing forces. The first is dynamic and is a portion of a reflex arc, that may have as its origin the muscular sense of the bladder or the cerebral idea of micturition, and has as

a result the contraction of the bladder. The second, on the contrary, is purely psychic and requires the temporary suspension of the voluntary action of the external sphincter. This is best realized by absolute mental distraction. If this distraction is not total the micturition is dribbling, deformed, difficult, interrupted, or impossible. Normally, the desire to urinate is induced by vesical distention and the act should not be produced until the bladder content reaches its physiologic limit. This is customarily impossible, and therefore the individual creates his own urinary habits, which permit the brain to control the sphincter. The mental condition then makes instinct subservient, and a subject worried by urinary preoccupation has his attention always attracted to the bladder. This results in pollakiuria, and the ultimate condition is a metamorphosis from a urinary neurotic to a psychopathic dysuric. Consequent upon this the bladder entertains a state of permanent irritability.

Symptomatology. Adults, women especially, between the ages of 40 and 60 are those usually attacked. They may otherwise appear in perfect health. In a second category are young women, whose general conditions are perfectly normal, but in this class, like the previous one, they are all manifestly neurotic, and the neurosis varies from a mild exhibition to a paranoic approach. To illustrate, in a case with which I am familiar the patient would have her attacks timed by the clock twice daily and indulge in pitiful paroxysms. If the hands of the clock were set forward or back the patient would have her cystalgic crisis at the scheduled hour. The balance of the day and night was spent in comparative comfort so far as the bladder was concerned. Following a practically painless cystoscopic examination, in another case, the woman sat staring into space, her hands firmly clasped and if any one addressed her she would cry and moan. This lasted for three hours the patient and her pain finally leaving when she was informed that the meter of a taxicab had been at work for a half-hour.

In practically all cases the patients are unable to state a definite cause. The attack has come on quite suddenly, progresses

rapidly to its height, and continues chronically for several months with remissions. The interval between attacks has in some of my cases been a year or longer. Several recurrences are noted in nearly all histories. At their first examination the patients have mostly all had the same diagnosis made—that of cystitis—and practically all have been given the same treatment, consisting of morphine hypodermatically and frequent vesical irrigations. As a rule no benefit follows; in fact, there occurs an increase in intensity of the suffering, most probably on account of the repeated distentions of the bladder, and the fact that the patient's attention is more attracted to those parts by recurrent interferences. In most cases the patients urinate more frequently during the day than at night, though the reversed condition may be seen, also the combination of nocturnal and diurnal frequencies. If the nocturnal variety obtains, the paroxysms begin usually at the same hour, and persist for intervals varying from one-half to one hour, and do not subside until early in the morning. During the day the frequency depends upon the amount of distraction. The number of spasmodically painful urinations are in large number if the patient is at home, the intervals may extend to three or four hours if the patient is on the street or shopping. A curious fact exists that as a class these subjects are very intelligent, refined, and well preserved, calm as to outward appearances and martyrs on account of their pain. Some tell of their spasms, moved by emotion, and relate that the births of their children were mild in comparison.

The pain is analogous to that of cystitis. The bladder and urethra either singly or combined become spasmodic and the contraction of the urethra may produce a state of retention with intolerable suffering. The pains occur with the bladder in any stage of repletion, and are referred to the urethra, glans, testicles, rectum, labia, or the lower vertebral region. These continue during the entire period of urination and may persist for a time following it. At this epoch the spasm may become clonic, and the rapidly opening and closing sphincter, expelling

successively a few drops of urine, add agony to the already pain-racked individual

Relief is secured for a certain interval, only to be dispelled by a recurrence of the tenesmus as soon as the exciting quantity of urine re-accumulates. In some cases the urinations are almost continuous. A succession of spasms occur, the patient voiding only a few drops of scalding fluid.

The appearance of the urine is for the most part limpid. Pus may be found in varying quantity. Suppurative affections of the upper urinary tract and of the bladder naturally increase the amount, but this has nothing to do with the urethrocystalgia as an entity. If cystitis in any form occurs it is usually possible to differentiate. It must be remembered that we are attempting to describe an affection for the most part free from infection and trying to avoid a too complicated description by excluding large suppurative processes. A small amount of pus of trigonal and cervical origin is accepted; this is not the cause of the trouble, but the result of it, and is produced by the hyperaction of the sphincter and the resulting congestion. It is unusual that more than a few blood cells are found. The cause is the same as previously mentioned, a greater quantity is significant. There is never the terminal hæmaturia, as it exists as a cardinal symptom of true cystitis. A cloudy sediment is occasionally produced in a specimen if allowed to stand for several hours, this cloud is composed of mucus and epithelial cells, some pus cells, and urinary solids. Bacteriuria is very common, it is of the colon type. It is usual to find a few microorganisms, though a urine containing myriads of them is not rare. This is simply a complication and has no direct influence upon the cystalgia.

A preliminary examination may disclose no etiological evidence. Occasionally a polyp, caruncle, or pseudocaruncle of the meatus or its vicinity is present; these have often been discovered by the patients or they have been informed of their presence during a previous examination. Much importance is attached to this, justly so in some cases; there are others in which the growth has

been cut or destroyed by caustics or cautery and no amelioration occurs. Of particular importance in many instances is the appearance of the external vaginal mucous membrane and that covering the urethra and its meatus. It assumes the ordinary characteristics of senile membranes, and discloses a sclerotic change, not only superficially, but in the sphincters underneath; and this change is more responsible for the urethrocystalgia in a certain category than any other cause; if evidenced by no other reason than that upon the passage of a catheter, sound, or cystoscope (and sometimes gradually increasing dilatation is necessary or the use of a considerable amount of force), the patient experiences a vast amount of relief, particularly during the entire following night, of course the symptoms return later, but the patients' spirits are improved and they see a ray of hope. It is appropriate at this time to suggest that too frequent dilatation will prove fatal to anticipated permanent relief. In some of these cases there is a decided vaginal orificial atresia, the introduction of one finger being all the patient can stand on account of the pain produced. The urethra is felt as a hard, resilient cord, and the meatus is an inverted slit that resists to a marked degree the passage of an appropriate rounded blunt instrument. Upon the introduction of fluid into the bladder, inflammation of that viscus is excluded. The capacity varies, of course, but there is practically no painful sensation caused by contact of the fluid, and some bladders previously emptied every few minutes with characteristic spasm allow the introduction of from 150 to 200 ccm before any sensation to distention is evidenced. It is wise at this juncture to allow the bladder to empty through the catheter into a glass and show the patient the actual vesical capacity. This is a part of the psychological treatment.

Cystoscopy is a matter of routine; and such patients as have a hypersensitive bladder (probably hysterical) are directed to insert a rectal opium suppository before leaving their homes and to drink several glassfuls of water, in this manner an examination may be made by the immediate introduction of the cystoscope. If this fails, the

exploration can be made at the hospital under ether, having previously administered a hypodermatic injection of morphine. The cystoscopy is followed by a urethroscopy, preferably with the Buerger instrument. An anal and rectal examination is very necessary, and may be done at this time.

I must confess that thus far I have not met with any extraordinary vesical evidence. There is always a congestive trigonitis and cervicitis, and the urethra frequently shows hæmorrhagic patches and granulations, with the presence of an occasional caruncle, papillary growth, or fissure. This latter is probably traumatic, and possibly produced by a too strenuous examination made previously. The vesical mucosa and muscosa is in keeping with the general senile changes. From time to time apparent deformities are noted, but these are produced by minus distention of the bladder. The body or cervix of the uterus may cause heavy projections at the summit, but these for the most part may be made to disappear by introducing more fluid into the bladder, if the uterine mass is not too enlarged or not much adherent.

In several cases with marked anterior colpocele nothing of importance was found save an extension of the congested area and moderate bladder deformity. In one a very tender cicatrix, the result of repair of a urethrovaginal fistula, was undoubtedly the cause of the urethralgia.

In the case of a male, aged 64, with perfectly limpid urine and absolutely no urethral or prostatic lesion, the urethrocystalgia followed closely upon a Whitehead operation in which the cutaneous flap was too short and produced a large ringlike prolapse of the anal mucous membrane. The patient had been bilaterally castrated but without favorable results.

My youngest patient, a perfectly healthy girl of 17, had no recurrence of her attacks after a single urethral dilatation with the cystoscope.

The treatment will not be considered further. It is evident that in each case a proper diagnosis must be made, and suitable therapy instituted, medically, surgically, and psychologically. The majority of these cases can be cured. The prognosis in some is not good, and there are a few in which treatment absolutely fails.

Deductions My investigations have led me to believe that the condition is a neurosis of reflex origin, the exciting cause being continuous with the bladder or contiguous to it. The theory is founded upon the fact of the composite innervation of the bladder, urethra, anus, rectum, and uterus by the sacral and coccygeal branches with the pelvic sympathetics. That the bladder is not the primary cause is proved by the absence of cystoscopic and urinary findings, except as has been previously stated.

THE BULGARIAN BACILLUS IN THE TREATMENT OF CYSTITIS AND PYELITIS WITH ALKALINE URINE¹

By FRANCIS R. HAGNER, M.D., F.A.C.S., WASHINGTON

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At the meeting of the American Association of Genito-Urinary Surgeons in May, 1914, Dr. John R. Caulk of St. Louis read a paper entitled, "Incrusted Cystitis and the Use of the Bulgarian Bacillus in Its Cure."

In this very severe form of alkaline cystitis

we were considered, to quote Unterburg, Lichtenstein, and others, to have been therapeutically helpless. Dr. Caulk's idea in using the Bulgarian bacillus to combat the alkaline urine is a very important addition to the successful treatment of these distressing cases.

¹Read before the Southern Surgical and Gynecological Association, Asheville, North Carolina, December, 1914.

Eight or ten years ago Young tried to cure alkaline cystitis by the implantation of the colon bacillus, hoping thereby to get an acid reaction by its growth in the urine. At the time Young was trying this I had an experience with a patient in whom the urine was markedly alkaline and cystoscopic examination showed a very contracted bladder ulcerated over its entire surface, with a deposition of phosphatic deposits over the ulcers. The proteus vulgaris was isolated from this case. Repeated attempts were made to inoculate the bladder with the colon bacillus, traumatism of the bladder wall being made at its injection in the hope of getting a growth that might cause an acid urine and destroy the proteus infection. The bacillus proteus, being a very resistant organism, seemed to kill the colon bacillus causing its disappearance almost immediately.

North in 1909 collected a large series of cases in which the bulgarian bacillus had been used. In a series of 300 cases he made mention of but two in which it was used in the bladder, and these were indefinite reports, so I feel sure that Dr. Caulk is a pioneer in this work.

It is a well known fact that certain species of bacteria are positively antagonistic to others as regards growth and development, an example of this being the well known disappearance of the normal flora of the urethra in the male during the course of an acute gonorrhoeal urethritis.

The most common organism found in alkaline cystitis is the bacillus proteus vulgaris. There are cases reported, however, in which the staphylococcus streptococcus and the colon and tubercle bacilli were found, but there is no doubt that the proteus vulgaris is the organism found most frequently to be the cause of cystitis when the urine is strongly alkaline. Lavage, instillations, etc., have very little effect, especially in those cases having a tendency to incrustation. In these patients there are bacteria growing which require an alkaline or faintly acid medium. The injection of any acid, mineral or organic, will afford a temporary change in reaction because of the frequent evacuation of the

bladder. In introducing an acid producing bacteria some unquestionably remain during urinations, become implanted, multiply, and create enough acid to transform the urinary reaction. In the bacterial battle which follows, the bulgarian bacillus soon demonstrates its superiority and so overwhelms the proteus that changes in the patient are often seen immediately.

It might be said, to quote Dr. Caulk, that the technique of injecting an emulsion of this bacillus into the bladder might be faulty for two reasons: (1) because of the danger of introducing other bacteria and (2) because these bacilli might be harmful. To defend the treatment against these objections it may be said that several cultures of these tablets of Hynson and Westcott were made by Dr. Thomas of Washington University, and on each occasion a pure culture of lactic acid was obtained. The bulgarian bacilli seem to lack resistance to chemicals and even to their own acid products, because when a certain degree of acidity is reached they die. One bladder irrigation of 1:20,000 bichloride will completely destroy these organisms.

Experimental work on dogs shows that injection of the organisms into the bladder followed by traumatism produces no evidence of inflammatory change in the mucosa, and the urine four days after injection is sterile; so I feel sure we can use this organism with safety in the bladder.

Dr. Caulk reports a very interesting case of alkaline cystitis with ulceration, deposition of lime salts, and the formation of papillary areas also incrustated with calcareous material. This patient had been operated upon a number of times, and the ulcers curetted, all forms of irrigations and instillations having been used with practically no benefit to the patient.

At the time Dr. Caulk began to use the bulgarian bacillus the patient was in a frightful condition, being troubled with tenesmus urinary frequency, blood, and offensive urine. Following the first injection the patient spent a much more comfortable night and was finally cured by the instillation of emulsion of the bulgarian bacillus.

The following is the method we have em-

ployed in our own cases: The bladder is first irrigated with sterile water (this is very important, as any antiseptic will probably prevent the growth of the bulgarian bacillus); three or four tablets are then dissolved in an ounce of sterile water, the mixture being well stirred, as these tablets are only in suspension. The solution is then injected into the bladder with a syringe and the patient is told to retain it as long as possible. The effect is often noticed at once, as the urgency and pain are diminished.

I will briefly cite a few cases showing the prompt action of this organism:

CASE 1. A patient 76 years old on whom a suprapubic prostatectomy had been performed. This operation was performed just before I left to hear Dr. Caulk's paper. When I returned six days later the patient was in a very precarious condition — inactive, somnolent, pulse weak, appetite poor, and showing every evidence of sepsis, although he had had frequent bladder irrigations, urinary antiseptics, etc., the putrid odor from his urine permeated his room. The edges of the suprapubic wound were necrosed, gangrenous, and covered with calcareous deposits.

The patient's condition was alarming and it seemed as if he would have an unfortunate ending. Urine collected from the suprapubic wound was strongly alkaline and contained myriads of large bacteria that proved to be the proteus vulgaris. The patient's bladder was irrigated with sterile water through the suprapubic wound, and four tablets dissolved in an ounce of sterile water were introduced into the bladder and allowed to remain. This was repeated every four hours, and on examining the patient next day his general condition was found to be much better. The offensive odor had entirely disappeared, the only odor noticeable being a slight sourness due to the bulgarian bacillus, and the urine was strongly acid. The tablets were then introduced three times daily. Seventy-two hours after the first introduction of the bulgarian bacillus the slough had entirely disappeared from the edges of the suprapubic wound, the deposition of lime salts had ceased, the urine was clear and the patient's general condition was most satisfactory.

The use of the tablets was continued three days longer. The patient made an uninterrupted recovery, the urine continuing to be acid. We have used this treatment on several patients having hypertrophied prostate where there was suffering from recurrent attacks of frequency and tenesmus with alkaline urine and but little residual urine, and the results have been quite as striking.

We recently had a patient who gave a history of chills, fever, recurrent attacks of urinary frequency, and tenesmus, extending over a period of three weeks, with cloudy alkaline urine. Cystoscopic examination showed a bright velvety area just behind the right ureteral orifice. X-ray negative for calculus. The possibility of tuberculosis of the right kidney was considered, but several urinary examinations failed to show the bacilli.

Guinea pigs inoculated continued to gain weight. This patient's right-kidney urine was strongly alkaline and contained much pus and some blood, while the urine from the left was but faintly alkaline, containing but a small amount of pus. Installations into the bladder improved the patient's condition, but the urine from the right kidney continued alkaline and the presence of pus continued in the urine. Culture from the ureteral catheter gave a pure culture of staphylococcus aureus. The kidney pelvis was injected with seven cubic centimeters of four per cent silver nitrate. Two days later the urine still contained pus and was alkaline. I then thought I would try injecting the kidney with the bulgarian bacillus. Two tablets were dissolved in ten cubic centimeters of sterile water and injected into the kidney pelvis through the ureteral catheter. The patient was comfortable for thirty-six hours when he had quite a severe chill, temperature going to 103.5° but becoming normal in twelve hours. The day following the injection, the patient's urine was acid, and although I made two more injections of bulgarian bacillus into the bladder no more treatment was directed to the kidney. The patient has now been away from the hospital three months, his urine remaining clear, acid, and free from pus.

Although a great deal has been said regarding the bulgarian bacillus, it is unquestionably a most useful therapeutic agent in cases of bladder infection with alkaline urine.

DEPARTMENT OF TECHNIQUE

CANCER DESTRUCTION BY RADIUM¹

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BY the word destruction is meant local removal of a neoplasm, in contradistinction to cure, the term cure meaning complete and permanent effacement of the malignant growth and its non recurrence in any other part of the patient. The word cancer in this paper is used in its generic sense and covers all malignant growths. The rationale of the complete removal of a tumor by radium application can be satisfactorily demonstrated only by a thorough microscopical examination of the involved tissues, carried out from time to time during the active treatment and after its completion. In this way the histological changes in the cells, morbid as well as normal, may be anatomically demonstrated and the actual effects of radiation upon these new growths, as well as upon the surrounding structures, may be accurately ascertained beyond question and in a definite manner.

Often, however, for good and sufficient reasons apparent to all of us, it is impossible to make these observations. We then have to depend upon the findings as exhibited by the clinical and objective symptoms.

A considerable amount of evidence is on record, from the writings of some of the best modern pathologists, which shows the structure alterations taking place during the application of radium. To quote only a few authorities:

Gauss describes the histological changes observed in ten pieces of tissue excised at various periods in a case where myomata were under treatment by radiation. Striking changes are shown. At the beginning a microscopical section shows adenocarcinoma, two weeks later a section in the same location shows connective-tissue and cancer nests, three weeks later still, the cancer evidences have disappeared and the microscope discloses nothing except benign tissue with epithelial debris.

Degrais and Bellot pointed out, in a recent publication, that when epitheliomatous cells are exposed to radium there is a hypertrophy of the nucleus and degeneration of the protoplasm,

together with a certain amount of keratinization. "This process was continued, and twenty days or so after radiation these epitheliomatous masses became transformed into keratinized debris. The formed elements break up and disintegrate, young fibroblasts and connective tissue cells, lymphatic cells, and polymorphonuclear cells infiltrate the growth and carry on a phagocytic function, and meanwhile cicatrization occurs at the expense of the hyperplastic and regenerated stroma of the tumor."

In a case reported by Atkins, of Toronto, a bone tumor involving the right tibia was removed January 6, 1914, and examined. The pathological examination showed that it was a myeloid and round celled sarcoma. Three weeks after radium treatment a portion of tissue was removed from the original location for further examination. The pathological report is as follows:

"The tissue examined consists of a portion of large fungating growth removed from the anterior portion of the thigh.

"The epidermal elements have completely disappeared and their places have been taken by a large fungating tumor which clinically is sarcomatous. On microscopical examination one sees that this is a sarcoma with very large cells and a few spindle cells. The sarcomatous tissue infiltrates all through it, there is no tissue reaction but a connective tissue stroma is present which is oedematous and filled with a pigment which is evidently haemosiderin. The nuclei are often very large. The size varies, but everywhere it shows mitotic figures and conforms to all the characteristics of malignant sarcoma."

"On June 4 the tumor was exposed continuously to the radium rays a dosage of 240 centigram hours being given and on June 15 another portion was removed.

"Here we see wonderful changes. In place of the sarcomatous fungating tumor we find a structure much reduced in size. The large cells of the growth under the influence of the rays have changed to smaller connective-tissue and spindle cells. The cells show necrosis and necrobiosis. The connective tissue cells have been mobilized and the leucocytic infiltration is most intense due doubtless to the trophic stimulus. The connective tissue has been vascularized not by a mere inflammatory reaction, but by a truly specific stimulus which has expressed itself in the definite form of connective tissue elements."

Another evidence of the histological changes produced by radium rays upon cancer-cells is

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shown in the case reported by Drs Aikins and Simon, of Toronto, in the *Dominion Medical Monthly*, September, 1914. This patient twelve years previously had the right breast removed for carcinoma. In March, 1914, a recurrence was noted in the left breast. It consisted of a hard mass of induration about one and a half inches in diameter. The nipple was retracted and glands were present in the axilla, together with other typical symptoms of carcinoma. Radium was applied several times by a capable expert, and at the end of the month of May the breast was removed. The following is the pathologist's report:

"A specimen of what proved to be an adenocarcinoma of the breast was submitted to us after being subjected to the influence of radium. We found the upper portion of the skin which previously had been reported to be infiltrated with the growth to be totally free from any remains of malignant tissue. Deeper in the tissue however, there seemed to have survived a diffuse growth, the cells being smaller as we neared the surface. These cells would also have been destroyed had radiation been continued.

"Some of the carcinomatous cells were markedly hypertrophied, some were monstrous, some vegetative, while the protoplasm showed marked eosinophilia, proving beginning degeneration. The various tissue elements had become broken up and eosinophilic; young fibroblasts had evidently replaced the growth in the parts nearer the surface."

Dominici and Barcat examined a specimen from healed radium burns. The tissues were composed of fibroblasts and connective-tissue bundles parallel to each other and parallel to the surface of the skin. The fixed cells became rarified, the chromoplasm of the parenchymal cell had disappeared and was changed into hyaloplasm. They noted that the connective-tissue bundles separated and the fibroblasts became thickened. These observers also discovered that those portions of the tissue which had been subjected to radium became essentially differentiated from those not within the radium field. All tissue cells are affected by the rays. The cells of the neoplasms are especially susceptible. As a general rule the more vicious the cell the greater the effect upon it of the ray. Normal tissue-cells are injured, but where they are in close relation with cancer-cells it was discovered that before they are hurt beyond recovery the cells of malignant growths are either destroyed or so changed that normal, healthy structure is substituted. Normal cells appear to have a greater resistance or a lesser susceptibility and are not so easily influenced by radiation. They recover more quickly after injury while the cancer-cells so affected recover their activity slowly or not at all, being often replaced instead by normal con-

nective tissue. This is the so-called selective action.

The conclusions drawn by Teitschlaender,¹ of Vienna, after repeated pathological examinations of malignant tissue exposed to radium applications are as follows. "The chief action seems to be the inhibition of karyokinesis and activation of leucocytes and destructive changes, allowing the abnormal tissues to degenerate."

In sarcomata the retrogression takes place according to the following law:

1 The size of the body and the nuclei of the large cells decrease

2 As they shrink the neoplastic elements elongate, but the shape of the nucleus becomes regular, and they eventually assume the form of large embryonic connective-tissue cells, forming into a celled mass similar to that of a true fibroma. Thus we may emphasize the fact that sarcomata are transformed by radium into a tissue analogous to that of a fibroma with myxomatous changes.

As regards epitheliomata and carcinomata under the influence of the radium rays, we find that—

1 The cells gradually diminish in size and staining properties

2 This atrophy corresponds, not to the metamorphosis of those definite, formed elements, but to their destruction, as shown by keratinization or absorption

3 The epitheliomatous cells disappear either by means of progressive absorption of protoplasm and nuclei through the leucocytic infiltration or by a sort of granular degeneration

The other processes associated with the development of every epithelial tumor are arrested, while vascular connective tissue is reorganized according to the method just described

As proof that the changes initiated by radium are such as lead to immunity, great importance must be attached to the cellular infiltration, first leucocytic, then later a round celled infiltration. It has recently been shown these activities require different reactions of the tissue for their function, hence radium must affect the blood. These infiltrations have always been noted in all cases of animal experimental transplantation of malignant cells and always accompany the cases in which the animal becomes immune and the tumor disintegrated

The pathological evidences of chemical, histological, and anatomical alterations in morbid and normal tissues from the effect of radium applications seems, therefore, to be abundant, substantial, exact, and incontrovertible. The

¹ Teitschlaender. Monatsschr. f. Geburtsh. u. Gynäk. 1213, xxviii, 296

clinical proofs of this action of radium are illustrated in the following cases. For the purpose of this paper those only have been selected in which the tumors have been proved by pathological examination to be malignant and in which, under treatment, the growth has disappeared.

CASE 1. J. S., farmer, age 61, March 21, 1914. Patient has basal-celled epithelioma of the neck, recurrent. Has an extensive and deep ulceration extending from the root of the ear down the neck. Part of the lobe of the ear is destroyed. The ulcerated surface is about three by two and a half inches in extent. The large vessels of the neck are exposed. Besides two previous operations the ulcer has been recently thoroughly cauterized. Forty milligrams of radium applied for 9 hours. April 10, 40 mg. of radium applied for 9 hours. April 16, 40 mg. of radium applied for 9 hours. April 21, the lobe of the ear is entirely healed and covered over with new skin and the ulcer is reduced to about half an inch in diameter, which is healing in rapidly. Forty milligrams of radium applied for 12 hours, and the patient left for his home the next day, writing me at the end of two months that the ulcer was entirely healed and that there was no further use for dressings. He received in all 1,560 mg. hours of radium in the course of his treatment.

CASE 2. J. I. I., storekeeper, age 57, October 9, 1914. Patient has a lump about the size of a small orange involving the upper part of the sternum at its junction with the clavicle extending posteriorly into the mediastinum and externally into the right cervical region. Three weeks previously a tumor of this size had been removed by operation and the wound had healed kindly and rapidly. Recurrence began about a week afterward. Pathological report as to tumor was that it was a carcinoma. Today 101 mg. was applied properly screened, over the region and allowed to remain for 20 hours. Patient going to his home in the country next day. October 16, he returned complaining of a slight burning of his skin but with the tumor reduced to about half its size. October 20 skin is still very tender, but the tumor has almost entirely disappeared. November 12, very slight evidence of tumor remaining, but he has two well marked radium burns—one rather deep eschar about an inch in diameter and another about half an inch in diameter—both painful and discharging—one to the right and the other to the left of the upper border of the sternum. December 10 the two sides of the sternum and each clavicle in the sternum region appear to be similar and normal. No evidence whatever of any tumor. The skin is still tender over the burned regions. Patient discharged. One radium application of 2,020 mg. hours.

CASE 3. Mrs. S., age 40 housewife seen September 10, 1914. History of carcinoma of the breast of two years standing. Breast removed November 10, 1913. Small nodules scattered around the wound and in the surrounding skin, recurrent in May, 1914. The pathologist's report was adenocarcinoma of the right breast. At this date 101 mg. of radium applied in divided tubes for 10 hours over a circle of about six inches in diameter. October 1, well marked radium burns present but healing. Some of the nodules have disappeared, but as the induration along the wound is still marked another application of radium was advised but refused on account of the burns. November 2, radium burns still present but slowly improving. A number of new skin nodules have appeared outside the circumference of the others. One hundred and one milligrams of radium applied for 15 hours. December 6 radium burns still severe. One large burn on

her side over a recent nodule is very deep and trouble some and is about an inch and a half in diameter, excavated and quite painful. One hundred and one milligrams of radium applied for 9 hours, changing the location of the application every hour. December 19, condition about the same except that some of the burns are healed. There are present at least a hundred nodules, some of them quite large. One hundred and one milligrams of radium applied for 22 hours changing the site of the application every two hours. The radium was screened by 8 mm. of felt as well as by 0.5 mm. of lead. December 23 nodules are slowly disappearing and only one of the large ones remains. February 5, 1915, patient is improving. Most of the burns have healed. The large burn posteriorly is still present, but the induration underneath it has gone, as have apparently most of the other nodules. Patient's general condition is very much improved. She has increased in weight, has better color and appetite, sleeps well, and is quite contented with her condition. One hundred and one milligrams applied to various parts of the lesion for 20 hours. April 15, patient has had two applications of radium of 101 mg. for 20 hours each time since the last note. The nodules have all disappeared except two or three suspicious spots in place of the hundred and more indurations she had when the treatment began. Two small radium burns still persist. Ninety milligrams of radium applied for 20 hours to the suspicious points. In her treatment this patient received in all 5,316 mg. hours.

CASE 4. Madame L. B., age 69, occupation, governess. Patient gave a history of having had a laparotomy for removal of a tumor of the uterus seven years ago. Six months previous to my seeing her she had a tumor removed from her back, which the pathologist reported to be a round cell sarcoma. One month later recurrence took place. On admission to the hospital at the site of a scar over the border of the left scapular spine, at its inner extremity, was seen a small ulcerated growth with characteristic odor. This the patient stated, had been present for about two weeks. On February 26, 1914, this growth was removed together with the remaining scar tissue. This was reported by the pathologist to be sarcoma. The operation wound healed kindly, but on March 10 as there seemed to be some tendency to infiltration of the skin at this point 40 mg. of radium element were applied for 2 hours. After the first application there was no further discharge, the induration and slight tendency to ulceration which had been present disappeared. There was no further pain or irritation of any kind, and the site of the operation wound was apparently normal except for a white scar line. Examination on May 10 showed no evidence of any return of the growth but 40 mg. of radium were again applied for 2 hours. April 10, 1915 there was no return of the growth. This patient received in all 1,120 mg. hours.

CASE 5. J. McF., age 55 occupation waiter, August 27, 1914. Twelve days ago the patient first noticed a tiny abrasion inside the lower lip to the right of the middle. On September 10 this had increased to the size of a large pea. October 10 the whole lesion was excised and the wound sutured. The pathologist's report was sarcoma. October 21 20 mg. of radium in two tubes were applied for 1 hour. October 23 the wound appeared entirely healed and stitches were removed. October 26, lip was apparently normal. Incision had healed by first intention. Thirty six milligrams applied for 30 minutes. November 12 20 mg. were applied to the inner surface of the lip and 20 mg. to the outer over the line of the incision for 40 minutes. December 10 20 mg. in two tubes applied for 40 minutes. The line of incision has practically disappeared. There has been at no time any local reaction

April 5, up to date there has been no return of the tumor. This patient had 550 mg. hours.

CASE 6 Rev C McC, age, 70, occupation, ecclesiastic, December 26, 1914. This patient has growth in front of left ear, raised three-quarters of an inch above skin surface and about one-half inch in its longest direction by three eighths of an inch in width, with superficial ulceration. This tumor has been growing for several months. Without removal 10 mg. of radium was applied for 20 minutes. December 30, no apparent reaction of the skin or tumor. The growth was removed with curved scissors under local anesthesia and immediately afterwards 50 mg. of radium was applied to the excavated base. Examination proved it to be epithelioma. January 27. Since the removal of the growth he has made weekly visits and 10 mg. of radium has been applied each time for 10 minutes. February 8, growth seemed to be slightly filling in from the bottom. Twenty-five milligrams of radium were applied for 10 minutes. March 10, up to date 10 mg. of radium for 10 minutes each visit have been applied for four visits since the last report. The ulcer has been completely destroyed and new skin is running in from the edges. There is no evidence of radium burn. April 6 patient called for observation. There is no change in the condition. Patient was told to return in a couple of months to see if further treatment was necessary. April 11. He died this morning of a sudden attack of pneumonia. In all this patient had 3,200 mg. hours' treatment.

CASE 7 F W, age, 16, school girl, March 17, 1914. Patient has suffered for several months from enlargement of the left lower jaw and adjoining lymphatic glands. Pathological examination of one of the glands showed it to be sarcomatous tissue of spindle celled variety. Forty milligrams of radium applied in divided doses for 4 hours. March 20, no local reaction from the preceding treatment, the swelling of glands and jaw was markedly lessened, 40 mg. of radium again applied for 4 hours. Two weeks later the patient appeared to have entirely recovered. There was no irritation or redness of the skin over the tumors. April 17, 1915 the patient's mother reports that patient is entirely well. She had 320 mg. hours.

CASE 8 F C, age, 42, occupation broker, October 17 1914. Patient has epithelioma of the floor of the mouth involving the lower jaw at the median line. This tumor was removed and the pathological report confirmed the diagnosis. October 22, 45 mg. of radium applied for 10 hours in divided doses to the inside and outside of the jaw, one tube of 25 mg. being applied 10 hours under the tongue close to the median line. October 29, under surface of the tongue somewhat inflamed and tender. Ten milligrams of radium, well screened, applied to the under surface of the tongue at affected point and 51 mg. to the under surface of the chin for 4 hours. November 12, no return of the tumor noticed, but there is a slight tenderness and superficial swelling at the root of the tongue behind the teeth at the site of the cicatrix. Skin on the under surface of the chin is red, tender, and scaling. No radium applied on account of tendency to burn. February 9, 50 mg. applied for 22 hours to the under surface of the chin. On account of a well marked burn on the under side of the tongue no radium is applied on the inside of the mouth. April 4, 1915, the radium burns have all disappeared and there is no evidence of any return of the growth. He has a slightly enlarged and tender lump in the middle line behind the prominence of the chin. Seventy one milligrams of radium applied to this point for 8 hours. This patient had in all 2,662 mg. hours of treatment.

CASE 9 J W, age, 51, occupation, ship's carpenter. This patient had epithelioma of the eyelid. Eleven

years ago he was operated upon for a similar tumor said to be malignant. The pre-ent tumor was removed, and pathologist's report showed it to be epithelioma. After excision the wound was united by three stitches, which parted on the third day, leaving a gaping wound. This was resutured, and at the same time 10 mg. of radium were applied for 20 minutes. No evidence of radium burn was noticed from either of these applications. At the end of three weeks from the first operation 10 mg. of radium were applied again for 20 minutes and the patient was discharged. This patient had 600 mg. hours' treatment. No recurrence when seen April 20, 1915.

CASE 10 J S, age, 58, occupation, farmer, June 20 1914. He presents himself with a large excavated ulcer of the base of the tongue extending forward along the right side of the tongue and across the back of the tongue to the left side. The tongue is badly swollen, saliva is excessive, great difficulty in masticating and it is almost impossible to swallow food or saliva. The whole tongue is exceedingly painful. The submaxillary and cervical glands of the right side are swollen and tender. He has lost about 40 pounds in the past five weeks. is unable to sleep from the pain, cannot take nourishment except in very small quantities, and is practically unable to swallow or breathe with comfort, lying down. His whole condition is pitiable. The tissue taken from the ulcerated edges of the sore by pathologists in his home town has been reported as epithelioma. One hundred and one milligrams of radium in four separate tubes with two mm. of lead screen applied well back on the right side of the tongue and covering part of the ulceration, for 10 hours, 5 mg. of radium also applied over submaxillary glands and changed from time to time. At the end of 24 hours the patient was discharged to go home to the country with the request to return in September. On August 25 the patient returned for observation. The ulceration at the back of the tongue had cicatrized, the swelling of the glands had disappeared. enlarged glands could no longer be made out in neck. the patient had increased 20 pounds in weight and was able to masticate and swallow any kind of food, extra secretion of saliva had ceased. Patient considered himself cured. Curiously enough he had a radium burn on the tip of the right side of the tongue, which he said was very much better than a few weeks ago and was evidently healing. In all he had 1,008 mg. hours of treatment.

CASE 11 Miss A, age, 32, occupation clerk. Entire breast and axillary contents removed on February 15 1914. Reported as adenocarcinoma. October 20, small nodules which had appeared in scar removed. November 21, several new, small indurations have appeared in the scar and around it. The largest is the size of an almond. Thirty five milligrams of radium were applied to the most prominent lumps for 12 hours. December 22 marked radium burn over site of larger tumor, which is nearly gone. The smaller one has disappeared but a number of new small nodules, the size of rice seeds are present. One hundred and one milligrams of radium applied for 22 hours.

These cases, although few in number, represent a variety of malignant tumors, all of which are susceptible of removal by use of radium. They do not by any manner of means represent the large number of patients afflicted with cancer of various stages and conditions where the degree of the disease and complications are such that our present knowledge and experience do not

permit us to encourage them to hope for a cure by means of operative procedures, the use of radium, sera, vaccines, or any other known anticancerous therapy. None of the above-reported cases are claimed to be cures. Time enough has not elapsed for such a claim, but as we learn more of the action of radium it is believed that more of the cancer cases which are looked upon as hopeless at present may be relieved by radium alone or by a proper collaboration of radium with the various other remedies at our disposal. In spite of the great advance recently in the methods and technique in using radium, there is still much to be learned. The amount needed depends upon the different purposes of application, the different depths of tissue to be affected, the variety of tissue, the degree of malignancy, its stage, the length of time of application, and many other factors still to be settled. All these indications can be defined only after much experimentation, long continued, together with a proper appreciation of our rapidly accumulating pathological knowledge of the action of this powerful remedy on living tissues.

Many phases are developed during the course of radium treatment. Certain cases of malignant growths yield rapidly to small quantities of the remedy, on the other hand, others are stimulated apparently by small doses. Some skins are extremely sensitive to very small quantities of radium. Other patients have skin which is not affected at all by large quantities continuously applied and frequently repeated, without regard to the protection supposed to be given by screening.

Curiously, exactly similar cases of malignant growths rayed exactly the same way, with the same amount of screening, the same length of time of application, in persons of as near as possible the same age and period of time of tumor, and where the previous operative treatment was similar, may and do give exactly opposite results. For example, Cases 3 and 11 were precisely similar to another case not reported here, where the recurrent nodules persisted and increased in spite of similar treatment in every way. The pathological report was the same, recurrence took place in the same manner, but after one 15 hour application of 100 mg. she went from bad to worse and died in a few weeks. My feeling is that one application was not sufficient and that in spite of apparent failure the treatment should have been persisted in.

To the lay mind a very serious complication is the burn which sometimes follows the application. This may be extensive and deep and at times very painful and difficult of cure.

Some of my patients have noticed the more rapid disappearance of portions of the growth under the burned area than under that portion unaffected in this manner. These patients sometimes ask to have the radium left on long enough to produce an eschar, believing this to hasten the cure.

The closer the radium to the object the greater the effect of the rays. As the rays shoot out in every direction from the center the ideal course of treatment would be to have the radium as nearly as possible in the middle of the tumor. Therefore a malignant growth in one of the normal tubes of the body and within reach of radium application—as, for instance, in the oesophagus, or the rectum—is theoretically much more susceptible to treatment, especially if the malignant growth surrounds the canal than where the neoplasm can be radiated from one surface only. If there is a sinus running to or through the tumor, or if it is in a location where it can be pierced to accommodate the insertion of the radium, satisfactory treatment can also be carried on. When neither of these methods is possible, we have to resort to what is called cross-irradiation or cross firing. In this means of treatment we divide the radium into capsules and place it on the opposite sides of the growth, protecting the skin from the burning rays as much as possible by means of screens of different thickness. All these details are matters of technique and depend upon the individual patient and the disease as well as upon the experience of the operator and upon his personal equation.

So little is yet known of the action of radium on living tissues and so much is still to be learned that, working as hard as one can and despite the vast amount of material, even with an ample quantity of radium, it may still be years before a proper and successful method of treatment applicable to each individual tumor can be satisfactorily and efficiently worked out.

Here are twelve patients with new growths, pathologically and clinically malignant. These neoplasms have disappeared during radium application. Following their destruction or removal the tissue at the former site of these tumors is now normal and remains so. Certainly these results merit our further careful consideration.

A MODIFIED GAS-OXYGEN-ETHER APPARATUS

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I HAVE used during the past six years in my anæsthetic work various makes of apparatus for the administration of gas-oxygen-ether. All of them I found had some good points, and likewise all of them had features which were more or less impracticable. For instance, one would be too bulky and heavy to carry around, another would have so many keys and attachments as to confuse the anæsthetist. Others would have warming devices which are not only unnecessary but positively dangerous, especially the flame in close proximity to ether. Others again were not portable at all, many of them possess a long tube between the rebreathing bag and the patient's face, which, in my opinion, does not contribute to the patient's comfort nor to the efficiency of the anæsthetic, and so on down the line. So that what I am offering in the illustration herewith represents not so much in originality on my part as it does a combination of good features from various makes of apparatus which

I have found by experience to produce good results and meet all the requirements of a good gas-oxygen-ether apparatus, at the same time dispensing with the unnecessary and impracticable parts of the other devices.

I am using here as a stationary outfit for hospital work a Teter stand with the bags removed and bottles substituted, so as to give the sight-feed principle of Boothby, and which is also used at present on the Gwathmey-Woolsey apparatus. Then I carry my gases through a small $\frac{5}{8}$ -inch rubber tube to a Coburn bag and valve piece attached to a Teter mask, which has had the expiratory valve removed and the hole closed. The valve arrangement attached to the Coburn bag is also used with some slight modification, I believe, by the White Dental Company in their new apparatus. It controls the gases from the bag to the patient by a sliding inner tube with a peg protruding through a slot for control by the thumb and forefinger of the hand holding the

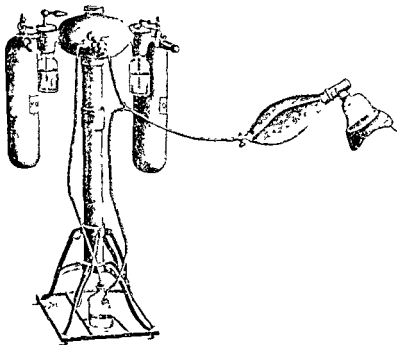


Fig. 1. A modified gas-oxygen-ether apparatus.

mask. The inner tube contains the valves which allow—

(1) Air breathing only, (2) inhalation from the bag and expiration through the valve outwardly, (3) a to-and-fro breathing into the bag for the rebreathing method.

Now, when ether becomes necessary for complete relaxation, it is supplied by converting the flow of gases down over the ether contained in a Wolf bottle of 500 ccm. capacity and then on to the bag. This can easily be grugged from a very slight odor of ether up to a sufficient ether saturation to obtain results. If a smaller Wolf bottle is used, this cannot be done, as sufficient ether vaporization cannot be produced from a smaller surface exposure.

Now, to make this a portable apparatus, one which may easily be put into a small grip for carrying around, simply disconnect the tubing from the stand proper and attach it to a double

reducer. Attach the double reducer to the nitrous oxide and oxygen cylinders which stand upon the floor, shorten the tubing which goes to the ether bottle correspondingly, the ether bottle also standing upon the floor. In this way you have just as good and practical an apparatus as you have with the stand, except you have not the sight feed. The reducer, however, has this advantage, that it gives you a constant and steady flow of gases which cannot be obtained without it, and this feature is greatly to be desired. One final word about this apparatus. It will appeal to the obstetrician where he desires nitrous oxide-oxygen to obtain, in a safe and sane way, the much talked about 'twilight sleep' in his obstetric cases.

The expense of assembling the various parts of this apparatus ought not to exceed thirty or forty dollars, outside of the stand, which is not an essential part of the portable outfit.

A NEW PROCEDURE FOR THE CURE OF CHRONIC SYNOVITIS

WITH CASES

By F. J. COTTON, M.D. F.A.C.S. Boston

SOME years ago the notion occurred to me that chronic joint hydrops, occurring as it does from time to time without causative, traceable infection, was surgically a question of drainage, that its persistence depended on a loss of absorptive power in the synovial membrane, a condition analogous to that presented by chronic scrotal hydrocele. It seemed to me that we were dealing, in this class of cases, with a lack of absorption rather than with any persistent over-secretion.

If this is true, why can we not deal with this troublesome condition by means of subcutaneous joint drainage?

An opening into a joint is ordinarily closed in early, the epithelial layer grows over the gap, and we are where we started.

How can we make a permanent joint drainage to meet chronic conditions? The answer is By securing a gap in the periphery of the capsule that cannot be covered with synovial membrane, in other words, a permeable scar open to the joint.

In 1912 I had my first opportunity to try this theory on a young man sent me by Dr. D. Sweet of Hartford, Connecticut, who showed a typical intermittent hydrops of one

knee of three years' duration without any obvious underlying lesion. It was of the rather usual type: ten days clear, then pain; then one day of sharp effusion, one day at the apex, one day of rapid absorption, and then another ten days clear.

I operated just after an attack. The moderately lax capsule was opened for an inch and the synovial membrane rolled out and sutured; the wound in the muscle and the skin wound closed.

Following the operation this young man had recurrent attacks of pain as before, but never for the year that I kept track of him was there any joint effusion at all.

I chanced on no other case suitable for this procedure until last autumn, though the condition of chronic, uncomplicated hydrops is not really very rare. The report of this case follows.

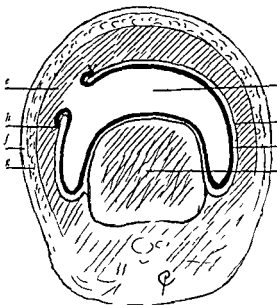
J. McN., student, at one time an athlete of note at another time a building contractor's assistant, 33 years old, tall rangy, and very powerfully built, though weighing only 160 pounds. He was referred to me by Dr. A. McK. I raster, on account of chronic hydrops of both knees. The effusion on the left side had been present for three years, though at one time, about two years ago, the swelling is said to have gone down to almost nothing for a time. The effusion came on gradually and has been almost painless, though very crippling on account of the limited motion, due to the mechanical effects of distention and to the loss of power from the very marked reflex atrophy of the quadriceps muscle. About a year ago there came on a

like swelling of the right knee, less, but in all other respects corresponding to that on the left. When he came to me the knees were alike, save that the right showed approximately two-thirds the amount of fluid present in the longer affected left knee. The left knee could be flexed hardly beyond the right angle, on account of mechanical hindrance from the tense joint. On the right motion was a little less limited. There was no tenderness to touch, no infiltration of the capsule, no sign of anything save free fluid within the joints, no indication of bone damage. On both sides quadriceps atrophy was obvious and rather extreme, considering the powerful general physique. No etiological factor could be arrived at, save that the patient had hurt the left knee in football work in his youth (never very seriously) and that he had had what was regarded as an apical tubercular process which had since healed under fresh air treatment, two and a half years ago. To the surgical ear the apices now show nothing abnormal. There was no question of specific history. This was not the symmetrical congenital luteic hydrops of Clutton.

Operation was advised and was done on December 5, 1914. A long, curved incision on the inner side of the left knee high up exposed a considerable mass of vastus internus muscle, which was split in the direction of its fibers. Beneath this lay a firm layer of fibrous capsule, still farther beneath and well differentiated lay the synovial lining, thin, pale, and abnormally tough in consistency. On opening this layer from one to one and a half ounces of viscid clear almost colorless fluid escaped. On exploration of the joint there appeared no lesion of any sort on the pale synovial membrane and the joint cartilages were approximately normal, though perhaps more white and less blue than in the average. Dr. Mallory's later report on the excised membrane gave no data save for the changes of a chronic inflammation.

The synovial membrane was pulled out through the cut in the fibrous capsule (a cavity of $1 \times 1 \frac{1}{4}$ inches) and then rolled back and carefully sutured (with catgut) so as to leave no exposed edge of synovial membrane. The joint was washed out with normal salt solution and left half full. The vastus internus muscle was brought together over the gap with lightly drawn mattress sutures of catgut, and the skin was closed in the usual way with interrupted sutures of silk worm gut. On the right the same thing was done. There was less fluid but in all other respects the joint was similar to its fellow. Both knees were bandaged down onto straight ham splints.

For two days there was a bit of temperature, apparently due to the not uncommon irritative effect of ether on a quiescent or healed lung tuberculosis. There was a bit of pain in the right knee, apparently from tight bandaging, for three days some fluid remained in the joints. After this there was nothing to note and the splints were removed at six days. He was allowed to sit up and to walk a little after nine days and at eleven days was discharged from the hospital. He was seen thirty nine days after the operation and showed no fluid and no infiltration. Save for the recent scars there was nothing to note except the quadriceps atrophy still marked on both sides. There was a little grating of the now dry articular surfaces on motion. Motion by the way was now much freer than before the relief of joint tension. He complained of no pain and there was no muscle spasm. Later there was some effusion in the right knee apparently without cause save for the negative pressure of the tremendously relaxed



Diagrammatic scheme of the drainage scar operation. a, femur, b, distended synovial cavity (quadriceps bursa), c, fibrous capsule, d, synovial lining, e, muscle layer into the interstices of which the scar affords drainage, f, skin, g, subcutaneous fat, h, the synovial lining everted and rolled back, caught with separate stitches back into the outer surface of the fibrous capsule.

capsule. This effusion subsided entirely under the moderate pressure of a Bender bandage, and is still absent February 24, 1915.

This scheme has worked out successfully in three joints operated on to date, a small series, but unanimous as far as it goes!

The whole notion of the operation is the establishment of a permanently permeable scar, not liable to obliteration by growth of the synovial membrane. I hope to establish the possibility of this more conclusively by animal experiments, already laid out.

In the meantime it is respectfully submitted that synovial membrane, like other epithelial and endothelial layers, cannot grow up and out of a corner, that total eversion of the membrane, as shown in the appended sketch, gives no point for even a beginning for the covering of the loose open scar that opens into muscle interstices, and that so long as such scar persists there can be no great accumulation of fluid within the joint.

I believe the principle to be new (at least as applied to joints) and worthy of further trial.

SUPRAPUBIC PROSTATECTOMY SIMPLIFIED¹

By G. SHILARMAN PETERLIN, M.D., F.A.C.S., SEATTLE, WASHINGTON

RECOGNIZING a time limit and that brevity is essential, both in the paper and its discussion, I shall omit etiology, symptomatology, diagnosis, and pathology and limit myself to operative technique. However, the following pathologic classification of prostatic enlargement must be borne in mind:

1 Adenomatous hypertrophy, a pathologic condition that permits of enucleation

2 Interstitial hypertrophy, a pathologic condition that does not permit of enucleation

3 Carcinoma, a pathologic condition that likewise does not permit of enucleation

The technique presented applies to the first and most frequent class of cases, and this fact should be borne constantly in mind during the discussion.

PREPARATORY TREATMENT

Patients should be in the hospital thirty-six hours before operation, except in cases which are difficult to catheterize, are infected, or have pronounced retention and low vitality. In these the duration of confinement previous to operation should consume only time sufficient to prepare them and to recover from the excitement and exhaustion of transportation to the hospital.

GENERAL PRE-OPERATIVE TREATMENT

The evening of entrance the patient should be given a hot sitz bath, with high salt solution enema castor oil, ccm. 10 (ounce, 1). Catheterization every six hours, followed by washing out with boracic acid solution, temperature 110° to 120° F. in percolator.

The following morning, if the bowels do not move freely, a high salt solution enema should be given. During the day the patient should take hot sitz baths, two or three, according to his vitality, also hot water bottles should be applied to the bladder and perineum to reduce congestion. The diet should be light. At least eight glasses of water should be given during morning hours. After 4 p.m. no fluid is taken so patient may have a good night's rest. For the same reason the patient is catheterized at 11 p.m. the night previous to operation and not again until next morning.

The back is prepared for spinal anesthesia from the fifth dorsal down, employing the usual most dressings for the sterilization of the field of operation. The pubes are shaved and sterile dressings

applied. If a general anesthesia is employed, pre-operative preparations on the table, such as catheterization, filling the bladder and sterilizing the field of operation, should be performed prior to the administration of the anesthetic, since with experience, complete anesthesia for five to ten minutes is sufficient to perform the entire operation. However, spinal anesthesia is recommended in practically all cases. So on the morning of operation, two hours previous to operation, high salt solution enema is given until the water returns clear. One hour prior to operation five to six glasses of water are given to produce polyuria after operation. A hypodermic is also given, consisting of morphine, $\frac{1}{6}$ gr. (gm. .01) to $\frac{1}{4}$ gr. (gm. .016), combined with hyoscin, 1.00 gr. (gm. .0066), one hour later hypodermic of morphine, $\frac{1}{6}$ gr. (gm. .01) to $\frac{1}{4}$ gr. (gm. .016), sufficient to make patient drowsy and allay excitement. In adaptable cases the hypodermic may be entirely omitted.

Local pre-operative preparations. The spinal anesthetic is injected. The solution used is stovaine compound, made after Dr. W. W. Babcock's formula. The technique of administration followed is that advocated by the same author and described in *STERCIA GYNECOLOGY AND OBSTETRICS*, November, 1912. After injection place patient instantly upon his back, then proceed as follows:

1 Catheterize the patient. If infection exists, wash the bladder thoroughly with boracic acid solution, temperature 110° F. in percolator, until the solution returns clear. Having previously ascertained the bladder capacity, fill the bladder to its fullest capacity, as a full bladder is essential to rapid and correct technique. Obviate guesswork by using a graduated glass percolator and percussing abdomen, as under anesthesia the capacity of the bladder without danger due to absence of pain may be increased.

2 When the bladder is filled withdraw the catheter and apply Zipser's penis clamp (Fig. 1), as this obviates loss of time since it is easily removed when necessary without disturbing the sterile operative field.

3 Sterilize the abdomen with soap ether, bichloride etc. not iodine. This method avoids the blistering and irritation of the skin as the skin surface becomes wet during and after operation.

¹Read before Physics and Club Seattle Washington January 12, 1915



Fig 1



Fig 2



Fig 3

Fig 1 Showing the Zipser penis clamp applied

Fig 2 The knees flexed and soles of the feet in apposition, with the bandage tied about the ankles and table

Fig 3 Feet, legs and thighs covered with a sterile sheet, well above the groin, leaving the anus exposed

4 Thoroughly flex and evert knees so as to place soles of feet in apposition. Place muslin bandage, 8' x 4", about each ankle, draw over insteps and once around feet, so as to keep soles of feet in apposition, and tie, then tie about table, so as to keep knees flexed. This bandage gives perfect position and obviates an assistant (Fig 2).

5 Cover with a sterile sheet the feet, legs, and thighs to well above the groin, yet leaving anus exposed (Fig 3).

6 Place double sheet, extending from knees to pubes, across thighs. This will serve as a rest for instruments and yet give free access to rectum without disturbing either sheet or instruments (Fig 4).

7 The technique for covering the remaining field of operation is that generally pursued—moist towels, with double sheet across chest and four dry towels held in place by towel clips and so arranged as to leave abdomen exposed from pubes to within an inch (2.5 cm) of the umbilicus.

8 Place on left hand three rubber gloves (Fig 5), the first drawn well up on arm, the second turned slightly back, and third turned back more than second. The object of this number of gloves is that when occasion demands that the left hand be withdrawn from the rectum the nurse can immediately draw off the outside glove and leave a sterile field without loss of time. The right hand is without glove.

OPERATION

The abdominal incision, two and one-half inches long (6 cm) is made in the median line. Retractors are inserted and held by assistants so as to expose distended bladder well. With a piece of gauze the peritoneum on the bladder is stripped back as high as possible. In the median line of

the bladder, just in front of the junction of the peritoneum with the bladder, a round needle carrying a silkworm gut suture is inserted transversely, care being taken not to puncture any veins. This suture (Fig. 6) is passed completely through the bladder-wall, mucous membrane, and all, taking a bite of one-half inch (1 cm), so as to give a firm hold. As soon as passed the needle is removed and both ends immediately clamped with a haemostat. This suture we term a stay and guide suture. An assistant holds this stitch taut, while the operator inserts a knife as close as possible to the same and directly in front of its center and opens the bladder toward the symphysis for an inch (2.5 cm). The knife is immediately withdrawn and retractors dispensed with. As the stitch is held taut it pulls the edges of the wound in apposition and prevents the escape of fluid and the collapsing of the bladder. The value of an uncollapsed bladder is apparent, it permits, before enucleation, of a thorough examination, by palpation of the bladder, for stones, the presence of sacculations, etc.

The assistant still holds the stitch taut, and the operator places the back of the index finger of the right hand on the same and, by following it down, immediately enters the bladder wound. This is the part of the operation in which the stitch serves as a guide suture and is very serviceable, inasmuch as it permits one to omit the use of retractors yet enables one to find the opening into the bladder at any time without hesitation, no matter how frequently the enucleating finger is withdrawn.

The left hand should now be placed beneath the transverse sheet (Fig 4). The Zipser clamp (Fig 1) is immediately removed from the penis. This clamp, if retained through enucleation, is



Fig. 4 Double sheet placed from knees to pubes across thighs serving as rest for instrument and yet allowing free access to rectum.



Fig. 5 Shows the three rubber gloves on hand also the instrument sheet permitting entrance of finger into rectum.

apt to cause retention of blood, which will clot in the urethra, producing post-operative sensation of urethral irritation, tenesmus, etc. The clamp being removed, the index finger or index and middle fingers of the left hand are inserted in the rectum and enucleation begun.

TECHNIQUE OF ENUCLEATION

The technique of enucleation is not difficult to attain if this fact is borne in mind that the enlarged prostate has practically two capsules—a true and a false one. The true capsule (Fig. 7) exists in both the normal and hypertrophied prostate and consists of layers of rectovesical fascia between which lies the prostatic plexus of veins. In a hypertrophied prostate, on the other hand, due to the growth of the adenomatous

masses, the outer portion of the prostatic gland is compressed against the true capsule, and a laminated fibrous envelop, free from blood vessels, composed of compressed prostatic tissue, is formed, called the false capsule (Fig. 8).

Bearing the above fact in mind, the index finger of the right hand, having entered the bladder, is inserted into the prostatic urethra. Often this forcible dilatation will cause an abrasion in the urethra which will naturally be between the adenomatous masses. Crook the index finger, force it into this opening sufficiently to stick the finger nail into the adenomatous mass, and attempt to hook it out, i. e., pull it toward the bladder. If it gives, which it will, the result is a cleavage in the laminated false capsule. Now push the finger to this point of cleavage, but always keep

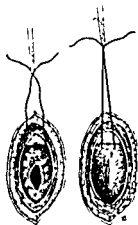


Fig. 6 Suture relaxed and tight

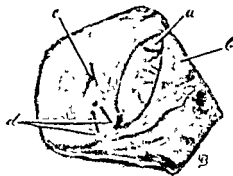


Fig. 7 Normal prostate cut in half. a—prostatic tissue dissected from true fascia. b—showing venous plexus which when injured causes so much bleeding in prostatectomy. c—urethra. d—ejaculatory ducts.

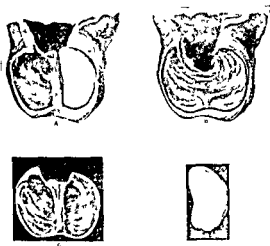


Fig 8 A, the original specimen in which one lateral adenomatous mass has been removed, B the bladder and outer part of the capsule C, the inner part of the "capsule" usually removed with the tumors D, one lateral adenomatous mass the other was exactly similar but is not shown (After Wallace)

the finger hooked and the finger nail toward or into the adenomatous mass, never toward the true capsule with its venous plexus, meanwhile pulling toward the urethra into bladder

If this technique is followed, the result is practically no hemorrhage, for after enucleation there is a hollow capsule, consisting of a protecting laminated layer of the false capsule lying against the true, and it is the latter that contains the veins that bleed—the prostatic plexus. But when we go through all the layers of the false capsule and enter the true capsule, hemorrhage begins and trouble commences

Every operator, however, must bear in mind that prostatectomy is a blind operation, depending upon the tactile and muscular senses. The tactile sense with experience soon tells the point of attack for enucleation, which is not always the same. Most frequently, it is some point in the urethra, as stated, but sometimes it is through the mucous membrane of the bladder covering the enlarged prostate. But it is the muscular sense which tells if the cleavage is taking place rightly—an important factor

Having enucleated the prostate, the adenomatous mass is brought to the opening in the bladder, seized by the assistant with a volsellum forceps. If the prostate is in one piece and the prostatic urethra at its junction with the membranous urethra does not give way easily (as frequently occurs), the assistant, before attempting to extract the prostate, should make traction on same,

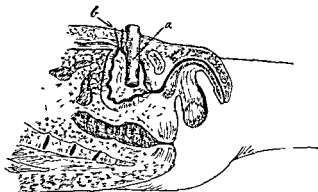


Fig 9 Drawing showing the tube (a), inserted through the bladder wound, pushed far enough so that the bladder walls will come above the lateral opening, b, stay suture

rendering this band tense, then it can usually be torn or cut through with the finger nails. If not, we cut it, employing a full-curved long-handled Emmett's scissors

After the prostate is removed, the prostatic cavity should be palpated for any small nodules, tags of mucous membrane or prostatic tissue, which should be removed. Especially is this true when the prostate is largely composed of separate adenomatous masses and chronic cystitis exists

The next step is insertion of the drainage tube. This tube should be $\frac{3}{4}$ of an inch (2 cm) in diameter and between four (10 cm) and five (13 cm)

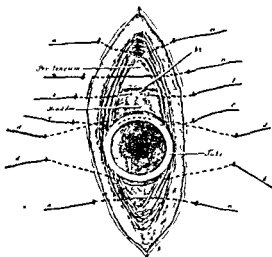


Fig 10 The tube in position showing a, through and through incision sutures b, stay and guide suture through bladder c, suture through tube for holding same d, traction sutures for closing wound when tube is removed

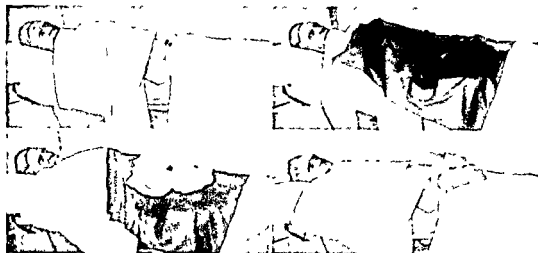


Fig. 11 (above) Showing tube in position after the wound is closed.

Fig. 13 Showing dressings piled high around and about the tube but not on top of it.

Fig. 12 (above) Piece of dental dam with small slit in center through which drainage tube is passed.

Fig. 14 Dressing in position.

inches long and possess two lateral openings each $\frac{1}{2}$ (1 cm) by $\frac{3}{4}$ inch (2 cm) (I never s drain tube).

The assistant holds the traction stitch lightly and the tube is now inserted through the bladder wound, pushed in far enough so that the bladder walls will come above the lateral openings (Fig 9), yet permit the base of the tube to remain some distance from the bottom of the bladder, as illustrated. The object of placing the tube in this position is as follows:

Should any hemorrhage occur, the blood will gravitate to the base of the bladder and there clot. The bladder walls being held by the stay suture (Fig 9b) above the lateral openings, the tube will not become clogged, for the supernatant fluid above the clots will pass out through the lateral openings, even should blood clots accumulate so as to occlude the lower end of the tube. If the

tube should become clogged (which it would with a smaller diameter and when placed so as to be in contact with the base of the bladder), tenesmus will occur. This act (tenesmus) opens the prostatic capsule, disturbs the blood-clot formed therein, and hemorrhage continues and is aggravated. Remember, therefore, it is the diameter of the tube combined with the position thereof, which prevents the post-operative hemorrhage, especially should the prostatic plexus be injured or traumatized.

The tube in position, two or three silkworm gut sutures according to the size of the wound, are passed completely through skin, muscle, and fascia, to close the incision (Fig 10a). One of these is passed through the tube to hold it in position (Fig 10c). In addition, there are two silkworm gut sutures similarly inserted each side of the tube, one passing above and one below the



Fig. 15 Showing catheter inserted through urethra in front of the lateral opening.



Fig. 16 Thread attached to glass rod which rests across wound.

tube, but farther from the edge of the wound (Fig 10d) These sutures we term traction sutures, and their use will be explained later. The stay suture (Figs 10b and 9b) is now threaded on each end and likewise passed through the fascia, muscle, and skin to the surface and is first tied. Tying this suture makes the bladder-wall tense, bringing the cut surfaces of the wall so close about the drainage tube as to prevent leakage and necessitate no other stitches to close same. The remaining stitches are now tied, except the two traction sutures (Fig 10d), the ends of which are left long and tied together.

Hot water is poured through the tube to see that there is no hemorrhage and to remove blood clots. The wound stitches and the skin surface about the tube being covered with a compound tincture of benzoin, the following dressing, suggested by experience in the dentist's chair, is applied.

Piece of dental dam, 24 by 24 inches, with a small slit in the center, through which is passed the drainage tube, as illustrated in Figs 11 and 12, and the dressings applied, as shown in Figs 13 and 14, care being taken to pile dressings high around and about tube, but not on top of same. This dressing keeps the patient and bed dry and also serves as a trough, by elevating one side of the dam and placing a basin at the other the bladder can be irrigated easily without soiling the bed.

The after treatment, which I will not discuss, is practically irrigation every four hours until there is no evidence of even slight bleeding, which is usually within twelve to twenty-four hours. When the bleeding stops the tube is removed. On the third day a catheter, on a Guyon catheter guide, is inserted through the urethra, up through the wound, the end cut off, and a No. 8 silk or linen thread passed through the same just in front of the lateral opening (Fig 15). The catheter is now pulled out through the urethra until it assumes a suspended position in the bladder like that of the

suprapubic tube, in this way preventing clogging or tenesmus, yet giving free drainage because elevated above the floor of bladder. The thread is then attached to the glass rod which rests across wound (Fig 16), and the traction sutures tied, pulling the edges of the wound close together.

We have found that this has proved a very comfortable and easily applied form of retention catheter after prostatectomy, as well as being aseptic, inasmuch as the meatus can be thoroughly wrapped with moist boracic-acid dressings, the penis pulled back over the catheter and the same cleaned, urethral irritation and urethritis being thus prevented.

One more word about the retention of the stay suture. As will be noted, it pulls the bladder-wall close to the abdominal wall (Fig. 15b) and in so doing elevates the floor of the bladder and maintains it in this position — a fact, I believe, that aids an attenuated, sacculated, or trabecular bladder more quickly to recover its tone, as it brings the floor of the bladder on a level with the mouth, and gravity aids in drainage.

As prostatectomy is an operation that will restore essential physiological activity, relieve intense suffering, and should have a very low mortality (less than one per cent), not only from a utilitarian standpoint, but from a humanitarian point of view, it becomes the specialist's duty to evolve a method of procedure that will give a high percentage of cures and a low percentage of mortality. These percentages can be obtained in proportion to the simplicity of the operation.

Based on numerous cases, extending over fourteen years, with this object in view, and acknowledging the pioneer work of Freyer, this simple technique has been evolved and is presented in the belief that any surgeon with general surgical ability and experience can perform this operation successfully with one assistant in any community, thus increasing the frequency with which this operation is undertaken and proportionately relieving human suffering.

GOITER OPERATIONS WITH SIMPLIFIED TECHNIQUE¹

By ARTHUR E. BENJAMIN, M.D., MINNEAPOLIS, MINNESOTA

THE technique of operations for goiter has not been modified by surgeons, in general, for a number of years. It is now quite universally conceded by the profession that the best results, in the treatment of the majority of

goiters, are obtained by surgical means. Most operators have adopted the technique of certain well known operators for this disease, such as Kocher, Mayo, Berry, and Crile. There have been but few individual departures from such

¹ Read at the Minnesota Academy of Medicine, February 3, 1915.



Fig. 1. The low collar incision of gaster.

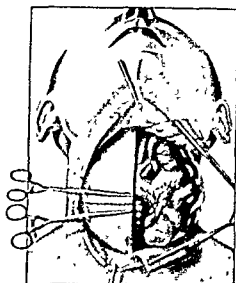


Fig. 2. Flexible forceps clamping fascia and muscles exposing enlarged thyroid.

operative plans. Articles have appeared describing the technique, notably among which are those by Mayo, Berry, Kocher, Balfour, Crik, Kausch and Mikulicz.

The operation in competent hands is now quite safe in simple goiters but it seems that there should be some improvement in the technique in order to make them more simple and to take into consideration the appearance and symmetry of the neck after the operation as well as the avoidance of possible further trouble.

Many patients do not come to the surgeon for the relief of general symptoms but for the purpose of avoiding mechanical obstruction to the trachea or because of the enlargement and ugly appearance of the neck on account of the growth.

The writer has worked for a number of years trying to perfect a type of operation which would be safe, simple, and satisfactory, and which would bring about a greater percentage of permanent cures, as well as add to the appearance of the patient's neck after operation.

The operation previously described in surgical literature such as the Mikulicz resection is not altogether new and is particularly applicable in the group of cases where there is more or less enlargement of both lobes, either of the cystic, colloid, or adenomatous type. It is this operation which I have attempted to modify and elaborate in my work, and report in this paper.

The Kocher incision is often practiced in

Europe, but the low collar incision has been quite generally adopted by American surgeons, it gives a better exposure of the two lobes of the gland and is capable of being easily extended.

In witnessing the usual operation for goiter and viewing such work from a critical standpoint, one is at once struck with the great number of forceps which seem to be necessary to control hemorrhage. The application of these forceps and the subsequent tying of ligatures around the clamped blood vessels consumes time. The numerous forceps employed are in the way and interfere with the work, the operator having to change their location or reapply them in order to proceed with the operation.

There is frequently an incomplete exposure of the gland and therefore some difficulty in controlling hemorrhage and in removing all of the diseased portion or a sufficient amount of the gland and in some instances overlooking the retrotracheal or other portion abnormally located.

The possible insecurity of ligatures that are applied just above the bite of the artery forceps has always appeared to me as a probable cause of postoperative hemorrhage. It was therefore thought best to substitute a more safe and positive method of securing the blood vessels.

The disturbed symmetry of the neck after many operations is not pleasing to the eye, nor does it favor the mental quietude of that patient whose sense of beauty is paramount.

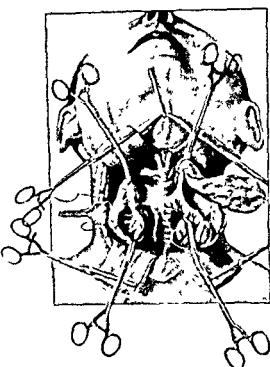


Fig. 3. Four flexible clamps controlling blood supply of thyroid. Diseased portion of thyroid being removed on left. The approximation of the remaining portion of gland and capsule on the right side.

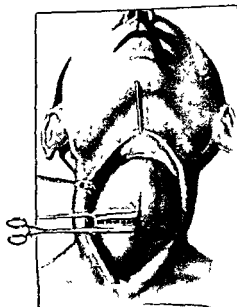


Fig. 4. Vertical incision and rod inserted.

DESCRIPTION OF OPERATION

A low collar or transverse incision is made, extending across the neck, equally distant from the midline. In this incision the skin, cutaneous nerves, and anterior external or possibly posterior external jugular veins and the platysma are severed, and in this manner two flaps are produced which are dissected from the underlying tissue one upward and the other downward, as is possible to expose thoroughly the area involved by the enlarged thyroid as shown in Fig. 3.

The beveled skin incision produces less of a scar when properly applied to the ordinary perpendicular incision in the skin. The sternohyoid and sternothyroid muscles are separated by a midline incision from the opposite pair down to the sternum up to the thyroid cartilage. The incision is then passed beneath the thyroid gland on one side, exploring the gland as a mass of lobes, separating it from the surrounding living tissue.

To the outer border of the incision a rod is passed through the fascial layer and sternohyoid.

eyond the incision, the rod is seated in the wound, and the incision is held open by the rod.

By the use of the rod, the smallest fracture will not be the presence of a

foreign body, and means removal of the foreign body, the seat of fracture, and chronic osteomyelitis.

Fractures may be under fearlessness and with the success as operations in the provided no non absorbable material. There are many different methods this may be accomplished.

autogenous intramedullary bone - which is perhaps the simplest - on the crest of the tibia or a portion of the ilium when that bone is

by the autogenous inlay of Albee, which is the most scientific procedure because it is similar to the structures into contact.

TREATMENT OF FRACTURES BY AUTOGENOUS BONE TRANSPLANTS

By FREDERICK G. DYAS, M D, F A C S, CHICAGO

THE purpose of this paper is to compare various methods at present employed in the open treatment of fractures in relation to the indications for their use. The history of the development of operative technique has apparently followed a rather definite plan in almost every field, e.g., first, the use of non-absorbable substances, and later, as the physiology and pathology of the tissue were better understood, the gradual substitution of other methods and the abandonment of the foreign body.

Possibly the earliest illustration of this is the use of the non-absorbable ligature of silk or linen, and sometimes even of wire. Many of us still remember the attempts to avoid the use of these materials, which acted as foreign bodies tending to produce infection and post-operative hernia, by the use of the angiotube. The highly efficient catgut ligature has been substituted for this instrument and the operative wound is now permanently closed at the end of the operation.

Similarly, we all remember the use of non-absorbable plates to fill up defects in the skull after fractures of the vault, the patient frequently being obliged to submit to a second operation for the removal of the plate because of the cortical irritation resulting from its presence, and because of its reaction to extremes of temperature, frequently incapacitating the patient from all active work. Skull defects are now either repaired by replacing fragments of bone or allowed to remain with only the soft parts as a covering to the brain, the gap being partially filled in after a time by the growth of bone from the margin, the dense connective tissue providing a sufficient protection to the brain. The results obtained by the latter method are always superior to those obtained by the introduction of a foreign non-absorbable body.

The employment of foreign bodies in abdominal surgery such as the anastomosis button, the bone bobbin, or the rubber ligature of McGraw in gastro-enterostomy, have been almost entirely abandoned in favor of the suture method, as experience has shown that these devices frequently act as irritating foreign bodies giving rise to symptoms which often necessitate their removal by a subsequent operation.

Every operator dreads the possibility of leaving a sponge in the peritoneal cavity. The

long train of symptoms which follows such a tragedy, as the patient always grows worse, necessitates the subsequent reopening of the abdomen as the only source of relief, while the unhappy surgeon is confronted with loss of prestige, if not with litigation.

It is a matter of every day observation that the peritoneum will withstand a considerable amount of infection if no foreign substance is present.

The metal filagree formerly used in the repair of large ventral hernias has given way to the radical cure by means of the imbrication of the fascia secured by suture.

These instances prove the statement made earlier in this paper, that foreign bodies are not well tolerated by the tissues and have, one by one, been replaced by methods of simpler technique not involving the introduction of irritating substances into the tissues. Many more examples might be given to substantiate this contention.

The instrumental technique as developed by Sir Arbuthnot Lane, and made necessary by the application of the steel plate to the fragments of a bone after reduction of a fracture, only emphasizes the fact that the smallest amount of a non-virulent infection will not be tolerated by the tissues in the presence of a foreign body.

The result of a non-absorbable foreign body, plus infection, in the tissues always means suppuration, necessitating the removal of the foreign body. When this occurs at the seat of fracture in bones, non union results, and chronic osteomyelitis may be the ultimate outcome.

The open treatment of fractures may be undertaken with the same fearlessness and with the same assurance of success as operations in the peritoneal cavity, provided no non-absorbable substances are used. There are many different methods by which this may be accomplished viz,

1. By the autogenous intramedullary bone transplant — which is perhaps the simplest — removed from the crest of the tibia or a portion of the shaft of the fibula when that bone is fractured.

2. By the autogenous inlay of Albee, which is possibly the most scientific procedure because it brings similar histologic structures into contact,



Fig 4

Fig 5

Fig 4 Case 3
Fig 5 Case 3 Defect in fibula Fragment of fibula
used for intramedullary splint



Fig 6

Fig 7

Fig 6 Case 3
Fig 7 Case 3 Defect from removal of splint Trans-
plant from crest of tibia

mony with the results of Lane, who rarely, if ever, gets an infection, but for the operator who must have the simplest method of fragment fixation with the minimum hazard of infection, or with infection inevitably introduced, who must provide a means by which the infected tissues will not be devitalized and succumb to the infection, the autogenous transplant offers the best chance.

The non absorbable foreign body must disappear from general use in bone surgery, just as it has from the surgery of other tissues.

I believe it safe to say that the man who has once used the bone transplant will never return to the metal plate as a means of fixation. Elaborate instruments are not necessary, but a good motor with saws and reamers is helpful. Our first case was done with a hand saw, chisel and mallet, and bone curette.

It is true that metal devices have their place in the treatment of certain fractures, but the employment of non absorbable substances is becoming more and more limited. The results obtained in our work with the autogenous bone transplants are set forth in the following case histories and illustrations.

CASE 1 J. G. age 34. On June 15 1914 the patient sustained a fracture of the right leg at about the junction of the lower and middle thirds and was taken to Cook County Hospital. A x-raygram showed an overriding of the fragments of the tibia of about an inch and a half. It

was impossible to reduce the fragments under ether anesthesia. Six weeks later there was no attempt at union and no callus.

On July 28 1914 the patient was put to sleep and after preparing the injured limb with tincture of iodine two parts glycerine one part an incision was made over the crest of the tibia for about eight inches. The fragments were sharply angulated and thrust through the incision. With a Gigli saw a portion of the rough fragments was sawed away. The rest was smoothed off with a bone biting forceps. The medulla was reamed out with a sharp curette and the wound covered with gauze.

The opposite limb was prepared in the usual way and an incision for about six inches made over the crest of the sound tibia. A portion of bone was removed by sawing the tibia about its middle and at a point four inches from that lower down, the portion included between the two saw cuts being removed with a broad chisel. This was removed without the periosteum. The wound was then closed, using catgut stitches for the periosteum and skin clips for the skin.

After trimming up our bone peg it was firmly driven into the medullary cavity of the upper fragment with the two ends of the broken bone thrust through the skin. Then, as the fragments were brought into alignment, the lower fragment received the protruding inch and a half of the bone peg, making a very firm union and holding the fragments in exact apposition and alignment. The periosteum was closed with catgut and the skin with skin clips. A posterior molded plaster of Paris cast was applied.

Two weeks later the patient fell and fractured the leg from which the splint had been removed. This was a green stick fracture and occurred in the area between the two transverse saw cuts. There was no displacement of the fragments and the fracture was not compounded. The leg was placed immediately in a cast and union took place after five weeks. The patient now is able to move about comfortably and has a strong leg on either side.



Fig 4

Fig 5

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Fig 5 Case 3 Defect in fibula Fragment of fibula used for intramedullary splint



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The non absorbable foreign body must disappear from general use in bone surgery, just as it has from the surgery of other tissues.

I believe it safe to say that the man who has once used the bone transplant will never return to the metal plate as a means of fixation. Elaborate instruments are not necessary, but a good motor with saws and reamers is helpful. Our first case was done with a hand saw, chisel and mallet and bone curette.

It is true that metal devices have their place in the treatment of certain fractures, but the employment of non absorbable substances is becoming more and more limited. The results obtained in our work with the autogenous bone transplants are set forth in the following case histories and illustrations.

CASE 1. J. G. age 54. On June 15, 1914, the patient sustained a fracture of the right leg at about the junction of the lower and middle thirds, and was taken to Cook County Hospital. A diagram showed an overriding of the fragments of the tibia of about an inch and a half. It

was impossible to reduce the fragments under ether anesthesia. Six weeks later there was no attempt at union and no callus.

On July 28, 1914, the patient was put to sleep and after preparing the injured limb with tincture of iodine two parts, glycerine one part, an incision was made over the crest of the tibia for about eight inches. The fragments were sharply angulated and thrust through the incision. With a Gigli saw a portion of the rough fragments was sawed away. The rest was smoothed off with a bone biting forceps. The medulla was reamed out with a sharp curette and the wound covered with gauze.

The opposite limb was prepared in the usual way and an incision for about six inches made over the crest of the sound tibia. A portion of bone was removed by sawing the tibia about its middle and at a point four inches from that lower down, the portion included between the two saw cuts being removed with a broad chisel. This was removed without the periosteum. The wound was then closed using catgut stitches for the periosteum and skin clips for the skin.

After trimming up our bone peg it was firmly driven into the medullary cavity of the upper fragment with the two ends of the broken bone thrust through the skin. Then as the fragments were brought into alignment the lower fragment received the protruding inch and a half of the bone peg making a very firm union and holding the fragments in exact apposition and alignment. The periosteum was closed with catgut and the skin with skin clips. A posterior molded plaster of Paris case was applied.

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CASE 2. A 12, 24, 30 came under observation Novem-
ber 10, 1914. Two months previously the patient suffered
a compound fracture of the left tibia in the lower third.
There was never any attempt at bony union, although
apposition seemed to be good. It has always been possible
to move the fragments around in any position.

A linear incision five inches long was made over the
site of the fracture at about the junction of the lower and
middle thirds. The periosteum was removed with a peri-
osteome and the fractured ends of the bone were pushed
through the incision. The connective tissue was cut
away and the ends of the bone freshened by means of a
saw, removing a small disc from each fragment. By means
of the reamer the medullary cavity of the upper fragment
was reamed out for a distance of three inches, making a
cavity half an inch in diameter. The medullary cavity
of the lower fragment was reamed out for about two inches.
The bones were then placed in apposition and the wound
covered with gauze. An incision was then made over the
opposite tibia, the periosteum removed, and by means of a
circular saw, driven by a motor, a bone splint, measuring
four inches by one half inch, was removed from the crest
of the tibia.

This was trimmed off by means of the saw and intro-
duced into the medullary cavity of the upper fragment for
a distance of two and a half inches. The lower portion
was found to be too long and was shortened about half an
inch, and then introduced into the medullary cavity of the
lower fragment. In the process of the introduction of
this bone splint the lower fragment was fractured a por-
tion being split off communicating with the medullary
cavity. This was held in place however by means of a
thick strand of kangaroo tendon wound around the frac-
tured portion of the fragment as an cast handle is wound.
The fragments were then brought into close apposition
the fascia sewed with catgut, and the skin held by skin
clips. A plaster of Paris cast was applied reaching from
the perineum to the web of the toes with the foot at right
angles to the leg.

The work with the reamer and saw was done by Dr
Emil Hoaglund, who used his electric motor and appliances.

CASE 3. M. O. male age 25 was first seen at Joliet
Illinois, on December 4. About two months before the
patient had suffered a compound comminuted fracture of
both bones of both legs in a runaway accident. He was
taken to St. Joseph's Hospital and an attempt was made
to reduce the fragments. The compound wounds were
treated aseptically and healed kindly. As there was con-
siderable displacement of the fragments and no attempt
at bony union, open operation was decided upon and done
on December 4, 1914 at St. Joseph's Hospital Joliet.
An incision over the fracture of the right leg was made for
about eight inches, and the fractured ends of the bone were
pushed through the skin incision, including the fragments.
The sharp irregular ends of the fragments were sawed off
squarely by means of a hand saw. A portion of the frac-
tured fibula about three inches long was then removed
this portion of the fibula was introduced into the medullary
cavity of the upper fragment.

The medullary cavity of the lower fragment was then
reamed out with the burr and, by exerting traction on the
lower fragment it was possible to introduce the protruding
portion of the bone plug into the lower fragment. This
brought the two fragments into close apposition and per-
fect anatomical relationship. The I smath bandage was
removed before the incision was closed, the bleeding points
ligated, the periosteum and fascia closed by catgut and
the skin by interrupted silkworm gut sutures.

An incision was now made over the fractured left tibia
extending for about ten inches. The fragments were

pushed through the skin incision and sawed off as pre-
viously by means of the hand saw, so as to get square
apposition. As the fibula was not readily available in this
case, an intramedullary splint was made by making two
crosscuts over the crest of the tibia and uniting these
crosscuts by means of a longitudinal incision through the
bone made by the circular saw. This gave us a bone
splint about three inches long by a third of an inch in
diameter. The medullary cavity of the fragments was
then reamed out by the burr, the plug first introduced into
the upper fragment and then, by exerting traction and
manipulation, the protruding part of the plug was reamed
into the medullary cavity of the lower fragment. The
I smath bandage was removed and bleeding points
ligated. The periosteum and fascia were closed by catgut
and the skin by interrupted silkworm gut sutures.

A plaster cast was now applied to each leg, reaching
from well up on the hip to the web of the toes, the foot
being held at right angles to the leg, the great toe, the
inner surface of the patella and the anterior superior spine
of the ilium being in a line. This was done on both sides
after protecting the soft tissues by dressings over the in-
cisions and sheet wadding along the rest of the limb.

The motor saws, and burrs were supplied by Dr. Emil
Hoaglund.

Dr. Charles Davison, of Chicago, who has
operated upon a number of these cases, advises
placing both legs in casts for four to five weeks
following the operation. He has followed this
practice in his own work, and in a recent con-
versation with him he said that he had no frac-
tures following the removal of the bone peg.

In all probability there is a bone absorption
at the site of the removal of the splint, causing
considerable weakness of the tibia at this point.
The suggestion has been made by Dr. Davison,
and recently carried out by him, of using a por-
tion of the tibia upon the injured side for the
intramedullary splint. This is a splendid idea
and undoubtedly will be much used in the future.

It is very desirable in the performance of this
operation to have suitable instruments with which
to work. While it may be accomplished by a
hand driven saw and reamer and by a chisel
and mallet, the operation is much facilitated,
and at times greatly shortened, by having a
good motor with which to drive the reamers and
the saws. Furthermore the danger of fracture
in the process of removing the bone splint is
very greatly reduced because of the lessened
trauma of the motor driven instruments. A
number of these are now upon the market.

In none of the cases occurring in our own
service, or in others observed in the wards of
other men in Cook County Hospital, in which the
autogenous bone transplant has been used in the
open operation for the fixation of fragments has
any serious infection occurred, and bony union
of the fragments so fixed has taken place within
the normal time limits for the bone in question.

To summarize:

1 Foreign bodies for the fixation of most fragments in the open treatment of fractures are unnecessary

2 Non absorbable material used in the open treatment of fractures predisposes to infection and osteomyelitis, and frequently must be removed.

3 Intramedullary bone transplants, or inlays, will frequently bring about union when foreign bodies have failed to do so.

4 The time of the operation is not increased by the use of the bone transplant.

5 The weakening of the bone from which the splint is removed is not a contra indication to the operation

6 The danger of infection is no more of a contra-indication to operations upon bones than upon other tissues when non absorbable substances are not used for fixation purposes.

TECHNIQUE USED IN APPLYING ANASTOMOTIC BUTTONS

By RICARDO FINOCHIETTO, M D, BUENOS AIRES, ARGENTINE

SINCE 1912 we have employed in the creation of neostomies, and especially in the application of anastomotic buttons, a procedure which facilitates the making of the purse-string suture. In each instance we determine definitely, by mathematical rules, the size of the incision to be made in the bowel to receive the button or catheter, and we make the field of operation completely bloodless.

The method consists in pressing between the blades of a hæmostatic forceps a designated portion of the wall of the stomach or intestine. Around the blades of the hæmostat a purse-string suture is inserted. Through the zone pressed together by the hæmostat, an incision is made, and the catheter or button is introduced into the bloodless incision.

TECHNIQUE OF THE APPLICATION OF THE MURPHY BUTTON

First step With the left hand the operator grasps from the wall of the stomach or intestine,

with a Ferner hæmostatic forceps, a fold perpendicular to the line of future incision. The size of the fold varies with the kind of button to be used. If the cylindrical button is used the amount of stomach-wall or intestine to be grasped by the forceps is equal to three quarters of the diameter of the button. If the oblong button is used, the size of the fold is equal to one-half the great diameter of the button (Fig 1). The forceps are completely and slowly shut. The purse-string suture is started at one side of the blades of the forceps. The needle progresses with wave motion going in and coming out of the intestinal walls, taking a stitch of the desired thickness. When the top of the fold is reached, the needle is passed through it, and the suture is continued on the opposite side. After turning around the tip of the forceps, the needle is passed through the top of the fold, on this side, is brought down to the anterior side, and ends in a point near to that at which the suture started.

Second step The forceps is taken away and we find that the mucous coat in the field, which has been held by the forceps, has disappeared, the

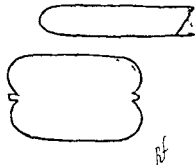


Fig 1 Showing the size of fold for oblong button

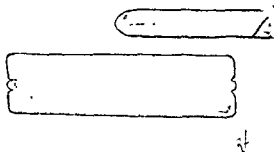


Fig 2 Showing size of fold for cylindrical button

tion of testicle into woman for dementia praecox, (6) transplantation of testicle

He performed his transplantations into the preperitoneal space, the cul-de sac of Douglas (extraperitoneally), the labium majus, beneath the mammary gland, the pubic region, the rectus muscle. He favors "exposed" implantation "The methods of Tuffier and of Martin of implantation within the pelvis and rectus muscle of ovarian tissue from living donors is a procedure entirely different from that under discussion. Heterointrapertoneal implantation within the pelvis is unnecessary and has an element of danger."

Tschernuschoff (127) described in detail his technique and stated that in autoplasmic transplantation of the ovary in sexually mature rabbits the transplanted ovaries take in their new location and fulfill their functions for a long time. Homoplasmic transplantation was performed on twelve rabbits and showed that the transplanted ovary may take and function for a while, but for a much shorter time than in autoplasmic transplantation.

George F. Dick and Arthur H. Curtis (102) say that autotransplantation of ovaries is successful in a rather small percentage of cases. Homotransplantation is considerably less successful. Attempts to produce experimental rickets by means of transplantation of ovaries were unsuccessful.

One of the most important contributions on this subject, in point of number of cases operated upon, is the several reports made by Professor Tuffier of Paris, whose various contributions may be summarized as follows:

"During the past eight years, from November 15, 1906, to July 15, 1914 I have performed two hundred and four operations thirty-five of which cannot be considered in this paper as they were performed only recently." This paper refers to a contribution read at the London meeting of the Clinical Congress of Surgeons of North America.

In speaking of homografting considerations, namely from one human individual into another, he states "I have performed this operation twenty-four times under the most favorable circumstances, but it did not

prove successful. I have performed seven heterograftings immediately after the removal of an ovary, or after the gland had been preserved in cold storage from one hour to forty-four days, and the operation has never given me a single functional result."

In speaking further of homografting he says: "I have transplanted an ovary from one young woman to another who presented, after the removal of ovaries and tubes, very severe symptoms simulating change of life. There was every chance for success as the patients were of the same age and of the same complexion. I should have been successful, but the blood of the patients was either hamolyzed or agglutinated on coming in contact. The results were nil."

However, he states, "I think with an improvement in technique we may later succeed in this procedure because the mechanism of absorption in such cases is well known. It is the same as for any foreign element—the foreign element being destroyed by the macrocytes. If we could prevent the macrocytes from attacking the grafted ovaries, it would be possible to obtain success. We already have learned from Carrel's experiments that the transplantation of limbs always gives a better result when the animal is infected. It is probable that the macrocytes in infected cases are occupied in struggling with the microbes and, consequently, are less liable to attack the grafted limb. While it is not within the province of surgery to produce infection in the human body, we do hope that some chemical substance will be discovered that may be used to protect the grafted ovary." Speaking of autografting he says "I have performed 145 of these operations. Two circumstances under which the operation may be performed may be cited. First, in total hysterectomy and transplantation of one or both ovaries in whole or in part. Eighty-four operations were performed in this way. The graft takes and every month it increases in size. This continues for two or three years but without any benefit to the patient. Second, I perform this operation in salpingitis, where the uterus remains in place. Sixty-five operations have been performed following this technique."

Tuffier discusses this whole subject under —

1. Justification for this operation
2. Surgical technique.
3. Results
4. Indications and future possibilities

He feels that the symptoms of menopause following the removal of appendages can be relieved if a portion of the ovaries can be preserved and transplanted

His results, he feels, justify the performance of this operation. His technique is extremely simple. "I take the ovary, or a portion of it, in a sterilized compress, the peritoneum of the abdominal wall is supported by the finger deeply inserted into the adipose tissue, and the ovary put into this opening and left there. When the glands are surrounded by adhesions they are very often torn in freeing them, their surface becomes irregular, and they appear wasted. Often, also they are sclerosed or contain cysts, but even in such instances the glands may be made use of and the results are good. If the glands are not quite aseptic, they may be dipped into tincture of iodine or passed through the flame of a lamp. The result in these cases however, is not so good. In cases of cystic change the ovaries must be opened before grafting. A small section of the pedicle of the gland is sometimes needed to enlarge the surface for future adhesions. In some recent cases the glands were divided into equal parts and implanted separately. This is done in order to obtain the smaller grafts and larger surfaces for adhesions."

Results He summarizes under —

- a, clinical,
- b, anatomical, and
- c, physiological

Clinical. After the transplantation where the uterus is left in place, the ovary remains unaltered for three or four months and seems to lie dormant. Sometimes it is a little tender, and the patient has all the symptoms of change of life. But after a while the ovary becomes active, enlarges, and is some times painful for five or six days, whereupon all symptoms subside and menstruation reappears. Generally the congestion of the ovary precedes menstruation by five or ten days. On the same day when menstruation

has commenced, all the symptoms of menopause disappear entirely. It is certain that with the grafting of an ovary the normal condition of the patient can be maintained. Speaking of the danger of the operation, he says: "This operation presents no more danger than does classical hysterectomy." Speaking more definitely of the menstruation results, he says "Of the sixty-five patients upon whom I performed autografting operations without hysterectomy, I have interviewed thirty seven from one to six years after operation, and thirty two had their periods regularly. In the five cases which did not have regular periods, two important points were noticed. First — the patients were either more than forty years of age, or second — they were septic cases where it was necessary to dip the graft into tincture of iodine." He differentiates menstruation following these operations due to a portion of an ovary being left in the abdomen, and due to the graft, by the following observation: "When menstruation is dependent upon the part of the ovary left in the abdomen (1) it appears two months after the operation, and I have never seen such a quick result from a graft, (2) the grafted ovary does not become enlarged just preceding menstruation, and it is curious to note that every time one ovary has been grafted and the other left in the abdomen, the graft never produces menstruation."

Under anatomical considerations, he states that grafted ovaries are the cause of menstruation by the following illustration. Transplant removed after four and one-half years. Macroscopically, a corpus luteum is found. Another transplant removed after three years contained a cyst the size of a nut, the veins and two of the arteries were the size of the finger. This case also contained a corpus luteum. Another was removed two years after regular menstrual flow had been established. The epithelial zone was regular, except where small hemorrhages were found.

In summarizing his future possibilities, he says "All recent cases of salpingitis, and all malignant diseases contra-indicate the procedure. After the fortieth year it is unnecessary. Another local contra-indication

exists in cases where strong adhesions are present between the ovaries and pelvis. In these cases, if the uterus is not removed, the patient always complains of pain in the lower abdominal region. With these exceptions, I can say that I am sure that my operation is a good one. Menstruation in young and very nervous women must be preserved, and especially in those suffering from hyperthyroidism, as these patients often exhibit nervous and congestive troubles.

"Ovulation without menstruation is, as I have explained, altogether useless. Improvement in heterografting is the most desirable advance at present. It should be stated that where the uterus is absent, ovarian transplantation is of no value."

Another very important recent contribution on this subject is one derived from the clinic of one of our Fellows, Dr. Frank F. Simpson of Pittsburgh, as contained in a paper by his associate, Dr. Sidney A. Chalfant.

"It sometimes happens," the author states, "that either from infection or damaged blood supply it is not safe to leave the ovary in the peritoneal cavity. All have been confronted by such a dilemma, and have wished for a simple solution of the problem."

In the clinic of Dr. Simpson this auto-transplantation is made by placing a piece of the better part of one ovary into the subcutaneous fat of the abdominal wall about two inches inside the anterior superior spine of the ilium on the right side. This particular location for the transplantation was chosen for the following reasons:

1. In case of infection or gangrene of the graft it could be removed by cutting one or two stitches.

2. In case of later pain the graft could be removed under a local anæsthetic without the necessity of a laparotomy.

3. The blood supply is comparatively good, from the superficial and branches of the deep epigastric arteries.

4. Protection is afforded by the anterior superior spine.

5. If infections of the graft occur, the abdominal wound will not be involved.

6. This point is easily accessible at the conclusion of the operation.

7. Most important of all, it is free from the dangers of intraperitoneal or retroperitoneal transplantation when there is a possibility that the graft is already infected.

The technique of the operation is as follows:

After the ovaries are removed, a portion or all of the better one is kept in normal salt solution at body temperature until the operation proper is completed. Then a small incision is made through the skin about two inches inside the anterior superior spinous process of the ilium. A pocket is made in the subcutaneous tissue by spreading a hæmostatic forceps, and into this pocket a section from the cortex of the ovary (about $2 \times 2\frac{1}{2}$ cm.) is inserted and the skin closed by plain catgut suture. This same technique is followed on all the subsequent cases except that in some transplantation is made on both sides.

Dr. Chalfant reviews the literature of transplantation of the ovaries and states:

"A study of the literature would indicate that certain facts in regard to ovarian transplantation are quite definitely established:

1. Homoplastic (from one animal to another of the same species) transplantation is only rarely successful.

2. Autoplastic transplantation for a time at least is usually successful. The onset of the menopause is prevented or delayed.

3. Even in the autoplastic grafts, degeneration is common after a longer or shorter interval."

Summary of cases. Ovarian tissue was transplanted in 32 patients; 23 of these were Dr. Simpson's cases and 9 were cases of Dr. Chalfant. The first one occurred on December 30, 1912, and the last one in this series January 27, 1915.

Immediate results. A number of the patients were bad surgical risks on account of long-continued infection or hæmorrhage. But one of the patients died.

Speaking of the graft, he states: "In spite of the fact that many of the sections were taken from the ovaries in intimate contact with pus tubes in only one instance was the graft infected. In that case (8) two grafts were made because infection was expected. The graft on the right side was infected and

was discharged at about the tenth day. The graft on the left side lived and caused no trouble. In all the others the grafts were palpable at the time the patients left the hospital. In no case was convalescence influenced by the graft. In a few instances there was a little local tenderness for a time."

In speaking of *ultimate results*, he divides his cases into:

1. Those in whom one ovary remains in its natural location,
2. Those from whom both ovaries were removed but the uterus remains,
3. Those from whom the uterus and both ovaries were taken.

In the first group there are thirteen cases. The graft was palpable in nine of these thirteen, the oldest one after one year. In two cases the graft increased in size, and was tender and painful a few days preceding menstruation. Only one patient complained of flashes of heat or other nervous disturbance, and it is probable that in this case the ovary was infected and destroyed.

There were two cases in which both ovaries were removed but the uterus remained. One of these was operated upon on May 22, 1914, and menstruated the first time September 6, 1914, and regularly each month, including February 1915. Flashes of heat were moderately severe just after leaving the hospital, disappeared with the onset of menstruation, and recurred again in March of this year, at the time of her expected period, but were less severe and lasted about three or four weeks. The other patient had not menstruated, menopause symptoms began three months after the operation, and have been quite severe.

There were seventeen cases in the group representing those from which the uterus and both ovaries were removed. Five patients gave evidence of continued function of the graft, if we admit that variations in size and increased tenderness are indications of functional activity as claimed by Tuthers. The first patient gave a very interesting history. The graft seemed to go through a regular cycle of about three months with a gradual increase in size for one week and with increased local tenderness, for two months the

ovarian tissue maintained its size and the patient felt "splendid," was much more energetic and less readily fatigued, and the symptoms of the menopause were much less severe. After two months the graft diminished in size, the tenderness disappeared, the patient became languid and easily fatigued, and the flashes of heat and nervous disturbances were very marked. From May to the latter part of November, 1914, the graft was small, but since that time she has been through one cycle and was just starting another at the time of examination. On several different occasions an irregularity of the graft was detected which corresponded in every physical characteristic to a normal graafian follicle. This has also been noticed in other patients. We are unable to offer any theory to account for this periodicity, but it has been observed by both the patient and her physician. Another one of Chalfant's patients, operated upon September 13, 1913, noticed that the graft varied in size. Of the seventeen patients in this group one died and one had removed and could not be located. In the remaining fifteen the graft was palpable in twelve, and not palpable in three. The graft was tender in six, but in only one was there much discomfort.

In regard to the effect on the menopause, he divides the cases into four classes:

1. Absent
2. Slight, where the symptoms were not constant, occurring usually at the time of the expected menstruation, and did not cause more than momentary disturbance.
3. Moderate, where the symptoms were more constant and troublesome.
4. Severe, where the symptoms recurred frequently during each day and caused almost constant discomfort.

Two patients (10.8 per cent) had no flashes of heat or nervous disturbances. In 7 (or 41 per cent) the menopause symptoms were slight, in 5 (29.4 per cent) they were moderate, and in 3 (or 17.7 per cent) they were severe.

Simpson and Chalfant, in an effort to have a definite basis for comparison, sent letters to about 150 patients from whom both ovaries and tubes had been removed. The letters

were sent to patients under forty years of age. Forty patients replied, either in person or by letter. Of these forty cases, four (or 10 per cent) had had no flashes of heat or nervous disturbances, seventeen (or 17.5 per cent) had had only slight disturbances, eight (or 20 per cent) described their discomforts as moderately severe; and twenty-one (or 52.5 per cent) as severe.

Comparing these four groups with the graft cases, we have these figures:

Symptoms of the Menopause	Patients with Graft Cases	Per cent	Patients without Graft Cases	Per cent
None	2	10.8	4	10
Slight	7	41	7	17.5
Moderate	5	29.4	8	20

In regard to these figures, the authors state that while it is clear that the number of observations is too small to draw definite conclusions from, and that while it is possible that the patients who have been uncomfortable after operations are more prone to answer a letter, thus affording themselves an opportunity to make a complaint still the comparison is interesting at least and is in accordance with the conclusions of Doctors Martin, Mellroy, and Liberoia, to the effect that transplantation lessens the severity of the artificial menopause.

Simpson and Chalfant conclude that—

1. Subcutaneous transplantation of ovarian tissue does not increase risk of operation.

2. In the majority of patients the graft will persist for a time. In this series it is still present at 27 months, 18 months, and in three patients at more than a year.

3. In some patients the graft appears to functionate, as shown by the apparent development of graafian follicles, by the variation in the size of the graft, by tenderness, and, when uterus remains, by menstruation.

4. The presence of one ovary in the pelvis does not necessarily interfere with the success of the graft.

5. Those patients in whom ovarian tissue has been grafted seem to have less discomfort from the premature menopause.

AUTHOR'S CONCLUSIONS

Careful sifting of the accumulated literature of ovarian-tissue transplantation leaves

a feeling of disappointment as to its surgical value in the mind of an impartial observer.

Autotransplantation of ovarian tissue, as the operation is at present practiced, retards and modifies the symptoms of the artificial menopause that is precipitated by castration in a definite number of cases, depending undoubtedly upon the ability of the graft to retain its vitality in the new environment.

The percentage of successful results in the autotransplant seems to be as large where the simplest technique is employed, using small pieces of ovaries tucked into pockets of well-vascularized tissue, as when a more complicated technique is employed with an attempt to definitely couple up the blood-vessels.

The fact that homotransplants and heterotransplants are failures, made with the same technique that is employed for successful autotransplants, demonstrates that there is a definite antagonism between the tissues of different individuals of the same species, and a prohibitive antagonism between the tissues of different species.

Occasional reports of successful homotransplants and heterotransplants encourages one to hope that in some way this antagonism of tissue will be overcome, and more successful work may result because of the greater precision thus would make possible in selecting more normal tissue.

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SUBCUTANEOUS TRANSPLANTATION OF OVARIAN TISSUE¹

REPORT OF 32 CASES WITH SPECIAL REFERENCE TO THE EFFECT OF SUCH TRANSPLANTATION ON THE MENOPAUSE

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IT seems to be a generally accepted fact that a part or all of one or both ovaries should be saved whenever possible.

It sometimes happens, however, that either from infection or damaged blood supply it is not safe to leave the ovary in the peritoneal cavity. All surgeons have met with such a dilemma and have wished for a simple solution of the problem.

Dr Simpson, in 1912 was confronted with the following

A young woman aged 21 had had about three years before a ruptured appendix with general peritonitis. At that time the abdomen was opened and drained. She later had her appendix removed and a third time the abdomen was opened for separation of intestinal and pelvic adhesions. These operations were done by three distinguished surgeons in another city. When first seen by Dr Simpson she was suffering so greatly that she was a semi-invalid and at each menstrual period was confined to bed at least a week, suffering in tensely. For an entire year operation was refused although repeatedly the father, the mother and the patient herself, all demanded a radical operation. Every possible effort was made to relieve her suffering both by local and constitutional measures. Finally, after all the other measures had failed Dr Simpson consented to operate provided he would be permitted to transplant some ovarian tissue into the subcutaneous tissue of the abdominal wall. It was explained that this was an effort to prevent or to lessen the severity of the symptoms of the artificial menopause that it was a relatively new procedure, and that the results were very uncertain. The operation, which was performed on December 30, 1912, consisted in the removal of the uterus, both ovaries and tubes, and the separation of intestinal adhesions. A piece of the better part of one ovary was transplanted into the subcutaneous fat of the abdominal wall, about two inches inside the anterior superior spine of the ilium on the right side. (For a description of the pathology, see Case 1.)

This particular location for the transplantation was chosen for the following reasons:

1 In case of infection or gangrene, the graft could be removed by cutting one or two stitches.

2 In case of later pain the graft could be removed under a local anæsthetic without the necessity of a laparotomy.

3 The blood supply in this region is comparatively good, from the superficial and deep epigastric arteries.

4 Protection is afforded by the anterior superior spine. This is better in a thin patient.

5 If the graft became infected, the abdominal wound would not be involved.

6 This site is easily accessible at the conclusion of the operation.

7 Most important of all, it is free from the dangers of intraperitoneal or retroperitoneal transplantation in those cases in which there is a possibility that the graft is already infected.

TECHNIQUE

After the ovaries were removed, a portion or all of the better one was kept in normal salt solution at body temperature until the operation proper was completed. Then a small incision was made through the skin about two inches inside the anterior superior spinous process of the ilium. A pocket was made in the subcutaneous tissue by spreading a haemostatic forceps, and into this pocket a section from the cortex of the ovary (about $2 \times 2 \times 1\frac{1}{2}$ cm) was inserted and the skin closed by plain catgut suture. This same technique was followed in all the subsequent cases, except that in some a transplantation was made on both sides.

REVIEW OF THE LITERATURE SINCE 1911

Martin (1) in 1911 reported his personal experience with ovarian transplantation and gave an exhaustive review of the literature and a complete bibliography. His third conclusion is of particular interest to us at this time. "It seems to be established that a small portion of ovary successfully engrafted anywhere furnishes to the subject of the graft the secretion or influence which preserves her sexuality, and prevents atrophy of the genital

¹Fellowship thesis presented before the American Gynecological Society, White Sulphur Springs, West Virginia, May 15-18, 1915.

organs and other changes in the individual that are coincident with complete castration."

Dr. Louise McIlroy (2) investigated the influence of ovarian secretion, grafted a piece of the cortex of the ovary on to the uterine wall, into the kidney, on to the parietal peritoneum, and into the uterine muscle. She found ultimate degeneration of autoplasmic grafts, the rate depending upon the vascularity of the site of implantation, the more vascular the less rapid but that atrophy of the uterus and mamma was prevented by the graft.

In another paper (3) the same writer arguing from these facts states that "the grafts become absorbed in time, but they have served their purpose in assisting the organism to become gradually adapted to the change in metabolism which occurs when any interference has taken place in the equilibrium maintained by the ductless glands."

A Libroia (4) experimenting on dogs made both autoplasmic and homoplastic grafts in the subcutaneous tissue, the abdominal muscles and the spleen. These were examined from four to nine months later. In the autoplasmic grafts he found marked degeneration of the ovarian tissue with infiltration by newly formed connective tissue at the earlier date which progressed to complete disappearance of specific ovarian elements and replacement of the organ with fibrous connective tissue, at the later date. In no case was he able to observe a regeneration of ovarian parenchyma. The homoplastic grafts were uniformly absorbed. Concerning the effect on the uterus and the animal as a whole he states "It is a fact worthy of note that in the animals in which I have practiced the graft there has been no noticeable atrophy of the uterus as should occur in young female dogs with double oophorectomy according to the research of Hegar and Sokoloff. I believe that while the ovary remains alive in the organism in which it is grafted—that is, before it completely degenerates—it continues to function through its internal secretion. As the degeneration proceeds slowly and progressively, the internal secretion is slowly and progressively withdrawn so that the organism habituates itself to this gradual suppression and is not disturbed when, through the complete transformation of all the ovarian elements into connective tissue this function fails completely."

Higuchi (5) made autoplasmic grafts on to the peritoneum of rabbits. In the animals killed after a year the grafted organ was almost completely transformed into connective tissue.

Uffreduzzi (6) using rabbits and guinea pigs investigated the possibility of making a new path to the uterus when the normal lumen of the tube is obstructed. He transplanted the ovary with and without its blood supply into the uterine cavity into the wall of the uterus projecting into the cavity, and into the end of the resected cornu. He also attempted to make an artificial opening in the side of the tube and in the uterine cornu after ligating the fimbriated extremity.

He concludes—

"1 The ovary transplanted into the uterus, or into its wall, is very quickly excluded from the cavity and is not able to ovulate directly into it."

"2 An artificial stoma in the tube or uterine cornu allowing communication with the peritoneal cavity, cannot be maintained. Sooner or later the wall closes and regenerates, the intestinal loops and parietal peritoneum frequently participating in the closure."

"3 In regard to the graft, the autograft takes constantly and remains vital indefinitely—in one experiment, beyond two years. Almost constantly there is a large increase of interstitial tissue, which may be accompanied by functional insufficiency. The other constituent parts may be considered as normal and without special characteristics."

Kawasoye (7) working with rabbits investigated the relation between degeneration and blood supply. He concludes—

"1 In the transplanted ovary even where a good take occurs, certain changes take place such as degeneration and atrophy. These changes are determined by the diminished blood supply."

"2 These changes occur in less degree in the ovary left *in situ*."

"3 It is here noteworthy that wherever possible in extirpation of tumors of the adnexa the whole ovary should be left or a piece of it with the least possible destruction of the afferent blood-vessels."

Jacobs (8) condemns on account of the danger of subsequent trouble and secondary operations, the conservation of the ovary and the ovarian graft. He cites a case of his own of pregnancy after double ovariectomy for a fibroid, due to incomplete removal of one ovary and says that he believes "it to be the same in almost all occurrences of pregnancy after bilateral oophorectomy, except in cases of multiple ovary which are exceeding rare."

"If we then discard as an excuse for these serious operations, the possibility of pregnancy if we may condemn the leaving behind of useless organs after a mutilating operation, we are near to admitting that it is superfluous to wish to combat the dangers of the artificial menopause by illusory and dangerous means which are able to give occasion for further surgical interference."

Tuher (9) from October, 1906 to October 11, 1911, has performed 130 ovarian grafts. Formerly he kept the graft in the subcutaneous cellular tissue during the operations and took them from there to transplant in the peritoneum near the stump of the uterus or the cervix. Recently, he places them in the subperitoneal connective tissue and leaves them there. He reports the source of the graft and nature of the operation in 119 cases and the results in 60 cases seen from 3 months to 3 years after operation. In the majority of cases the single or double autograft was successful in that it persisted and showed a periodic congestion. The heterografts and the cold storage grafts uniformly failed.

In his experience the effect on the menopausal

symptoms depends upon the presence of the uterus. Without menstruation the graft has no effect in preventing these symptoms. When menstruation does recur there is a period of amenorrhea of 3 to 7 months, with all the symptoms of the menopause, which disappear at once when menstruation occurs. Each menstruation is preceded by a period of congestion of one of the grafts, if two are present never both at the same time. This period of congestion occurs six to eight days before the flow.

In the discussion of Tuffier's paper, Hartmann (10) states that he believes the operation is one to abandon, and that Tuffier's report will be useful in deterring others from engaging in the same line of work. If an ovary is to be preserved it should be left in its normal position.

Tuffier in his later paper (11) reports additional cases and concludes that "ovulation without menstruation is, as I have explained, altogether useless. Improvement in heterografting is the most desirable advance at present. In closing it should be stated that where the uterus is absent, ovarian transplantation is of no value."

Davidson (12) reports three cases of autoplasmic transplantation, two of which were successful in that menstruation occurred. He took vertical or horizontal slices from the ovary and transplanted them into the rectus muscle after the peritoneum was closed.

Whitehouse (13) reports one case of autoplasmic grafts in which menstruation was at first irregular but at the end of one year seemed to be regularly established. He kept the ovary in the pouch of Douglas during the operation and before the incision was closed the healthy half of the ovary was cut into minute fragments and these were scattered into the subperitoneal connective tissue, and within the rectus muscle and rectus sheath.

De Rouville (14) reports in detail a case of autoplasmic transplantation, one ovary under each edge of the abdominal incision, with recurrence of menstruation, metrorrhagia, and later pain and tenderness in the grafts which necessitated their removal after eighteen months. Ovarian tissue was still living with "graafian follicles in process of growth, some follicular cysts, a large hypertrophied corpus luteum in process of degeneration, corpora albicantia, etc." Menstrual and intermenstrual bleeding ceased at once after removal of the grafts.

In a later paper (15) the same author reports eleven cases with results in nine. In only one was the result really favorable from a clinical point of view, in a second it was of debatable value, and in a third favorable but of short duration. From an anatomical viewpoint there appeared to be, except in one case, a more or less rapid atrophic evolution in all the grafts. The patients most favorably influenced appear to be given the benefit of a slow and gradual deprivation of their ovarian glands.

To those who attempt homoplastic transplantation in an effort to overcome sterility, the work of Castle and Phillips (16) is especially interesting.

One hundred and forty-one guinea pigs were castrated and each grafted with the ovaries of another guinea pig. One hundred of these were mated with males. Three of them bore young resembling those that would be expected from the guinea pig from which the ovary had been removed and not such as would be expected from the foster mother. In 87 cases no ovarian tissue was found post-mortem. In 11 cases, in spite of supposed perfect castration, part of the ovary remained. Three of these bore young whose color characteristics indicated that they had come from regenerated ovarian tissue rather than from the graft. This was in all cases confirmed by autopsy.

Guthrie (17) used chickens for his experiments and came to conclusions exactly opposite to those of Castle and Phillips (16).

Varonoff (18) was particularly fortunate in his experiments on sheep. Under local anesthesia he removed the ovaries of one ewe and put in their place the ovaries of another ewe. In practically every case the ewes bore healthy lambs. These experiments would seem to be open to question as to whether the castration was perfect, as no autopsy reports are given.

Storer (19) reports a case of transplantation of a portion of the remaining ovary into a cavity in the corua of the uterus, made by dividing the stump of the tube until the uterine cavity was laid open. Sixteen months after operation menstruation ceased and the patient showed all the symptoms of pregnancy. Three and a half months later she expelled, with some hemorrhage, a mass of detritus and the uterus decreased in size. This seems to have been an abortion of an early pregnancy retained for some time after the death of the fetus. Unfortunately, no pathological examination seems to have been made.

A study of the literature would indicate that certain facts in regard to ovarian transplantation are quite definitely established.

1 Homoplastic (from one animal to another of the same species) transplantation is only rarely successful.

2 Autoplasmic transplantation for a time at least, is usually successful. The onset of the menopause is prevented or delayed.

3 Even in the autoplasmic grafts degeneration is common after a longer or shorter interval.

SUMMARY OF CASES

Ovarian tissue was transplanted in 32 patients (23 of Dr Simpson's and 9 of the writer's), the first one on December 30, 1912, and the last one in this series January 27, 1915.

In every instance it seemed necessary to remove the ovaries, as stated in the detailed

reports, on account of infection, extensive cystic degeneration, damage from extensive adhesions, or impaired blood supply. In practically every instance, the tissue transplanted was abnormal.

IMMEDIATE RESULTS

1. Of the operation

One patient (Case 29, writer's patient) died at the end of 26 hours from a peritonitis due to the bacillus aerogenes capsulatus.

This was a fibroid with a tubo-ovarian cyst, cystic ovary and intestinal adhesions. Autopsy showed no perforation of the intestines and the infection probably gained access through the intestinal wall which was injured in separation of the adhesions.

Case 1 had a very rapid pulse for three or four days after operation, probably due to a hyperthyroidism.

Case 17 (writer's patient) had a particular stormy convalescence. The second day after operation she developed a tachycardia with pulse of 210. The heart quieted down under digitalis and bromides. About the sixth or seventh day she developed a left sided pleurisy with effusion, and later on empyema which necessitated resection of a rib. She left the hospital with drainage from the chest, but this later cleared up leaving some thickening of the pleura. This patient has a mild hyperthyroidism which probably accounts for her tachycardia.

A number of the patients were had surgical risks on account of long continued infection or hæmorrhage.

2. Of the graft

In spite of the fact that many of the sections were taken from ovaries in intimate contact with pus tubes, in only one instance was the graft infected. In that one, Case 8, two grafts were made because infection was expected. The graft on the right side was infected and was discharged at about the tenth day. The graft on the left side lived and caused no trouble.

In all the others the grafts were palpable at the time the patients left the hospital. In no case was convalescence influenced by the graft. In a few instances there was a little local tenderness for a time.

ULTIMATE RESULTS

Function. These patients who have had transplantations are naturally divided into three classes:

1. Those in whom one ovary remains in its natural location;

2. Those from whom both ovaries were removed but the uterus remains,

3. Those from whom the uterus and both ovaries were taken.

1. *Those in whom one ovary remains in its natural location* (13 patients). In all these patients the remaining ovary was not perfectly normal and there was a possibility that it might require removal, or that the internal secretion from it might not be sufficient, so that it was thought wise to conserve as much ovarian tissue as possible.

In the first one of these (Case 3), it was thought at the time of operation, that all of the ovarian tissue had been removed, but later, by examination, what appeared to be the right ovary was found. It was almost of normal size and somewhat cystic. It probably was a piece of the ovary that was torn off in separating the dense adhesions and had since increased in size. In this case the graft was not palpable.

The graft was palpable in 9 of the 13 cases, the oldest one (Case 9), after one year. In two cases (9 and 16), the graft increased in size and was tender and painful a few days preceding menstruation.

Only one patient complained of flashes of heat or other nervous disturbance, and it is probable that in this case the ovary was infected and destroyed.

2. *Those from whom both ovaries were removed but the uterus remains* (2 patients). One patient (Case 16) operated upon May 22, 1914, menstruated the first time September 1, 1914, and regularly each month including February, 1915. Since that time there has been no menstrual flow. Flashes of heat were moderately severe just after leaving the hospital, disappeared with the onset of menstruation, and recurred again in March, at the time of her expected period, but were less severe, and lasted about three or four weeks.

The other patient (Case 17) has not men-

struated. Menopausal symptoms began three months after the operation and have been quite severe.

3. *Those from whom the uterus and both ovaries were taken* (17 patients) Five patients (Cases 1, 6, 8, 9, and 14) give evidence of continued function of the graft, if we admit that variations in size and increased tenderness are indications of functional activity as claimed by Tuffier.

The first patient gives a very interesting history. The graft seemed to go through a regular cycle of about three months. There was a gradual increase in size of the graft for about one week, with increased local tenderness. For two months the ovarian tissue maintained its size and the patient felt "splendid," was much more energetic and less readily fatigued, and the symptoms of the menopause were much less severe.

After two months the graft diminished in size, the tenderness disappeared, the patient became languid and easily fatigued and the flashes of heat and nervous disturbances were very marked. From May to the latter part of November, 1914, the graft was small, but since that time the patient has been through one cycle and was just starting another at the time of examination. On several different occasions an irregularity of the graft was detected which corresponded in every physical characteristic to a normal graafian follicle. This has also been noticed in other patients. We are unable to offer any theory to account for this periodicity, but it has been observed repeatedly by both the patient and her physician.

Another patient (Case 6) operated upon September 13, 1913, has noticed that the graft varies in size. She says that it has disappeared for as long as two months at a time and that again it was as large as an orange, but that it has been palpable the greater part of the time. She has had no flashes of heat or nervous disturbance. On April 10, 1915, she noticed for the first time a little bloody discharge lasting only a few hours which she considered a menstrual flow. She had had a supravaginal hysterectomy.

Of these 17 patients, one died and one had

moved and cannot be located. In the remaining 15, the graft was palpable in 12, not palpable in 3. It was tender in 6, but in only one (Case 7), was there much discomfort. This patient has such a very unstable nervous system that it is extremely difficult to reach a true estimate of the severity of her discomforts. Distinct variation in the size of the graft was noticed by three patients.

EFFECT ON THE SYMPTOMS OF THE MENOPAUSE

So far as the menopausal symptoms are concerned, the cases may be divided into four classes: (1) absent, (2) slight, where the symptoms were not constant, occurring usually at the time of the expected menstruation and not causing more than momentary disturbance, (3) moderate, where the symptoms were more constant and troublesome, (4) severe, where the symptoms recurred frequently during each day and caused almost constant discomfort.

Two patients, 10.8 per cent (Cases 2 and 6), had no flashes of heat or nervous disturbances, in 7, or 41 per cent, the menopausal symptoms were slight, in 5, or 29.4 per cent they were moderate, and in 3, or 17.7 per cent they were severe.

Of these 3, one is suspected of having a mild hyperthyroidism. Another surely has this condition. According to Tuffier (11) hyperthyroidism increases the severity of the artificial menopause.

In an effort to have a definite basis for comparison, letters were sent to about 150 patients from whom both ovaries and tubes had been removed. As all our transplantation cases with two exceptions, were 40 years or under, only those of a like age were included. This includes all the patients since January 1, 1905, in Dr Simpson's service from whom he found it necessary to remove both ovaries, together with a few of the writer's patients. Only 40 patients replied either in person or by letter.

On these 40 cases, 4, or 10 per cent, had no flashes of heat or nervous disturbances, 7, or 17.5 per cent had only slight disturbances, 8, or 20 per cent, described their discomforts as moderately severe, and 21 or 52.5 per cent as severe.

The two series of cases are contrasted in the following table:

Symptoms of the Menopause	Patients with Grafts		Patients without Grafts	
	Cases	Per cent	Cases	Per cent
None	2	10.5	4	10
Slight	7	41	7	17.5
Moderate	5	29.4	8	20
Severe	3	17.7	11	27.5
Total	17		40	

While it is evident that the number of observations is too small from which to draw definite conclusions and it is also possible that the patients who have been uncomfortable after operations are more prone to answer a letter, and thus have an opportunity to make a complaint, still the comparison is interesting at least, and is in accordance with the conclusions of Doctors Martin, McIlroy, and Lohrsta, to the effect that transplantation lessens the severity of the artificial menopause.

CONCLUSIONS

1. Subcutaneous transplantation of ovarian tissue does not increase the risk of the operation.

2. In the majority of patients the graft will persist for a time. In this series it is still present at 27 months, 16 months and in 3 cases more than a year.

3. In some patients the graft appears to functionate as shown by the apparent development of graafian follicles, by variation in size, and tenderness, and when the uterus remains, by menstruation.

4. The presence of one ovary in the pelvis does not necessarily interfere with the success of the graft.

5. Those patients in whom ovarian tissue has been grafted seem to have less discomfort from the premature menopause.

REPORT OF CASES

For the sake of brevity, the history, diagnosis, and details of operation, have been omitted. Only the gross pathology is given for the same reason.

CASE 1. Miss B., age 21, referred by Dr. J. P. McElvly, Pittsburgh, Pennsylvania. Three previous abdominal operations by other surgeons.

Operation, December 30, 1913, by Dr. Simpson. Supravaginal hysterectomy, salpingo-oophorectomy, bilateral, extensive intestinal and omental adhesions separated, ovarian tissue transplanted.

Pathology. Both tubes closed over by adhesions from previous peritonitis due to ruptured appendix.

Right tube closed, convoluted and adherent to right ovary and posterior surface of broad ligament. Left tube convoluted, not closed, adherent to sigmoid. Both ovaries cystic, seat of chronic interstitial inflammation, each about the size of an English walnut. Uterus in fairly normal condition. Omental adhesions to under surface of incision, to bladder, to uterus and ad. exa, quite sensitive. These adhesions had drawn the transverse colon almost to the incision making a decided angulation.

February 7, 1914, cor. pairs of flashes of heat at time of expected menstruation.

Examination March 10, 1915. Ovarian graft very definitely palpable, a little larger than at the time of operation, slightly tender. This increases in size and stays large for two months, then becomes decidedly smaller and remains small for one month. Patient complains of severe nervous disturbance and severe flashes of heat during the time the graft is small and at this time is large and tires easily. When the graft is large patient is energetic, much less readily fatigued and is troubled only to a slight degree by nervousness and flashes of heat. Her nervous troubles are probably increased by hyperthyroidism.

CASE 2. Miss N., age 26 years, referred by Dr. E. M. Davis, Broughton, Pennsylvania. Appendix, right ovary and greater portion of right tube previously removed by another surgeon.

Operation June 29, 1914, by Dr. Simpson. Supravaginal hysterectomy, left salpingo-oophorectomy, two pieces of ovarian tissue transplanted.

Pathology. Left ovary almost completely detached by tension of pedicle and would probably have been free in a short time. Ovary cystic, about one and a half times normal size. Uterus about normal in size, removed on account of fact that patient had been bleeding excessively. Omental adhesions to anterior abdominal wall.

Examination March 19, 1915. Graft palpable, no tenderness, no variation in size. Has not been troubled in any way by flashes of heat or nervous disturbances.

CASE 3. Mrs. L., age 35, referred by Dr. J. P. McElvly, Pittsburgh, Pennsylvania. Appendix and both tubes removed by another surgeon nine years before.

Operation July 6, 1913, by Dr. Simpson. Supravaginal hysterectomy, bilateral oophorectomy, transplantation of pieces of each ovary.

Pathology. Uterus normal size, densely adherent. Right ovary cystic throughout, size of goose egg. Left ovary cystic throughout, embedded in broad ligament and covered by sigmoid and omental adhesions.

Examination February 10, 1915. Graft not palpable. No flashes of heat or other nervous disturbances. Examination shows part of right ovary remaining in the pelvis, cystic, about size of normal ovary.

CASE 4. Mrs. S., age 30, referred by Dr. George Speicher, Rockwood, Pennsylvania.

Operation, July 9, 1913, by Dr Simpson. Hysterectomy, salpingo-oophorectomy, bilateral; small pieces of ovarian tissue transplanted on left side.

Pathology. Bilateral pyosalpinx. Small amount of pus in each tube. Both ovaries cystic. Uterus, both ovaries and tubes adherent.

Examination, March 26 1915. Graft not palpable. There has been no discomfort at the site of transplant. Flashes of heat began about two months after operation, are very slight, and recur about time of the expected menstrual period. Nervous condition is much improved.

CASE 5. Mrs W., age 20, right tube and ovary previously removed by another surgeon.

Operation, September 16, 1913, by Dr Simpson. Supravaginal hysterectomy, left salpingo-oophorectomy, separation of adherent sigmoid from old line of incision, ovarian tissue transplanted.

Pathology. Sigmoid adherent to line of incision of previous operation. Left pyosalpinx containing about one and a half drams of pus. Right ovary cystic throughout. Right ovary and tube adherent. Uterus retroverted and densely adherent. Inflammatory cyst containing about two ounces of fluid on left side.

Patient has moved and cannot be located.

CASE 6. Mrs F., age 24, referred by Dr J H Repman, Charleroi, Pennsylvania.

Operation, September 27, 1913, by Dr Simpson. Supravaginal hysterectomy, salpingo-oophorectomy bilateral, appendectomy, two pieces of ovarian tissue transplanted on right side.

Pathology. Old ruptured ectopic gestation of left side with small quantity of old blood in pelvis. Hydrosalpinx of right side containing about one ounce of fluid. Both ovaries cystic. Extensive intestinal adhesions. Uterus, tubes and ovaries all adherent. Appendix linked by short meso appendix and chronically inflamed.

Examination, April 10, 1915, Dr Repman reports that the graft is palpable, has varied in size and has been as big as an orange. No flashes of heat or other nervous disturbance. She has today, for the first time, a slight bloody discharge which she considers menstrual flow. This continued only a few hours.

CASE 7. Mrs M., age 36, referred by Dr E A Kuhns, Emlenton, Pennsylvania. Right tube and ovary, a part of left tube, and appendix previously removed by Dr Simpson.

Operation, October 30, 1913, by Dr Simpson. Supravaginal hysterectomy, left salpingo-oophorectomy, ovarian tissue transplanted on right side.

Pathology. Chronic metritis and endometritis, left ovary cystic, slightly enlarged.

Examination, March 15, 1915. Graft palpable, decidedly larger than at time of operation. Patient complains of discomfort over transplanted ovary and states that it annoys her all the time. Flashes of heat began shortly after leaving the hospital of moderate severity. Patient thinks she is more nervous than before her operation.

CASE 8. Mrs J., age 34, referred by Dr. E. Onstott, Saltsburg, Pennsylvania.

Operation, March 23, 1914, by Dr. Simpson. Supravaginal hysterectomy, bilateral salpingo-oophorectomy, appendectomy, one piece of ovarian tissue transplanted on each side.

Pathology. Multipodular fibroid. Three pedunculated nodules attached to the fundus, two of them about $2\frac{1}{2}$ inches in diameter, one quite small. Tubes and ovaries adherent. Tubes contained a small amount of pus, and ovaries completely cystic. Appendix slightly inflamed by continuity. A small fragment of the left ovary remains in the pelvis.

Examination, March 5, 1915. Graft palpable on the left side. (Right side was infected and was discharged during stay in the hospital.) Patient states that three times since operation lump in left side became larger and tender, lasting two or three days. Last period of enlargement was about three weeks ago. Slight flashes of heat, for one month or two, soon after leaving the hospital. Has not been troubled for the last eight months. Examination at this time could detect no trace of ovary in the pelvis.

CASE 9. Miss C., age 23, previous appendectomy and suspension of the uterus by another surgeon.

Operation, March 27, 1914, by Dr Simpson. Dilatation and curettage, perineorrhaphy, left salpingo-oophorectomy, ovarian tissue transplanted on right side.

Pathology. Laceration of perineum. Left tube and ovary adherent and covered by adherent sigmoid. Left ovary cystic. Right tube and ovary normal, remain.

Examination, March 11, 1915. Graft palpable. Patient states that slight tenderness exists at times, more marked at the menstrual period, and that she notices a lump at that time which is not present at other times. Menstruation regular and normal. No menopausal symptoms.

CASE 10. Mrs M., age 33, referred by Dr E. Davis, Broughton, Pennsylvania.

Operation, March 31, 1914 by Dr Simpson. Dilatation and curettage, perineorrhaphy, supravaginal hysterectomy, bilateral salpingectomy, right oophorectomy, appendectomy, transplantation of ovarian tissue.

Pathology. Laceration of perineum. Uterus normal size. Adhesions between intestines and posterior surface of uterus. Tubes both adherent and inflamed and interstitial nodules on both sides. Left ovary cirrhotic. Right ovary shows a little hematoma, otherwise normal, remains. Chronic inflammation of the appendix.

Examination, March 8 1915. Dr Davis reports that the graft is not palpable. There has been no discomfort at site of transplantation and no flashes of heat or other nervous disturbances.

CASE 11. Miss S., age 30, referred by Dr David Boyce, N S Pittsburgh, Pennsylvania.

Operation, April 6, 1914 by Dr Simpson. Dilatation and curettage re attachment of the sacro-

uterine ligaments at lower point on the cervix, retroperitoneal shortening of round ligaments, resection of both ovaries, appendectomy, transplantation of ovarian tissue on right side

Pathology Retroversion of uterus Left ovary curthotic Right ovary cystic, size of goose egg Both tubes normal Appendix adherent and chronically inflamed

Examination, September 4, 1914 Dysmenorrhoea has been getting less each month Uterus normal position Graft palpable No further report could be obtained

CASE 12 Mrs C, age 37, referred by Dr R M Sands, Pittsburgh, Pennsylvania

Operation, April 8, 1914, by writer Dilatation and curettage, trachelorrhaphy, right side, bilateral salpingectomy, left oophorectomy, appendectomy, transplantation of ovarian tissue

Pathology Deep laceration, right side of cervix Both tubes and ovaries densely adherent Left ovary decidedly cystic was removed Right ovary fairly normal, remains Appendix normal

Examination, April 2, 1915 Graft palpable about same size as at time of operation No local pain or tenderness Menstruation regular, normal in amount and duration. No symptoms of menopause

CASE 13 Miss M, age 30, referred by Dr J I Johnston, Pittsburgh, Pennsylvania

Operation, April 14, 1914, by Dr Simpson Supravaginal hysterectomy, right salpingo-oophorectomy, transplantation of ovarian tissue right side Patient has had two minor operations for dysmenorrhoea but was not relieved Pain is very severe requiring morphine each month, and operation was decided upon in order to relieve patient from her pain and to remove the danger of contracting the morphine habit

Pathology Uterus small, otherwise normal Right ovary cystic Left ovary appears normal Left tube and ovary remain

Examination March 20, 1915 Dr Johnston reports the graft not palpable Slight tenderness occasionally at the site of transplantation No flashes of heat or nervous disturbance

CASE 14 Mrs K, age 24, referred by Dr J I McLallen, Wilkesburg, Pennsylvania Appendix previously removed by another surgeon

Operation, April 17, 1914 by Dr Simpson Dilatation and curettage, bilateral trachelorrhaphy, separation of omental and intestinal adhesions, right salpingo-oophorectomy, transplantation of ovarian tissue on right side

Pathology Bilateral laceration of cervix Both ovaries equally cystic Right one very painful, was removed Left ovary remains Omental adhesions to the old scar and sigmoid adherent to left broad ligament

Examination March 25 1915 Graft is palpable and patient states that it varies in size No tenderness at the present time No flashes of heat Much less nervous than before operation

CASE 15 Mrs. S, age 42; referred by Dr A. T. Hepler, New Bethlehem, Pennsylvania

Operation, May 13, 1914, by Dr Simpson Dilatation and curettage, perineorrhaphy, corpus luteum expressed from right ovary, cavity closed, left salpingo-oophorectomy, retroperitoneal shortening of round ligament, right side, appendectomy, ovarian tissue transplanted on right side

Pathology Laceration of perineum Retroversion of uterus Right ovary curthotic contained small corpus luteum cyst Right tube closed and adherent, outer half taken Left ovary cystic and adherent Left tube closed and adherent

Examination, April 10, 1915 Graft not palpable No local tenderness Menstruation regular since operation Has recently become excessive and prolonged No symptoms of the menopause

CASE 16 Mrs S, age 31, referred by Dr H M Welsh, Leechburg, Pennsylvania

Operation, May 22, 1914, by Dr Simpson Dilatation and curettage, bilateral salpingo-oophorectomy, appendectomy, transplantation of ovarian tissue on right side

Pathology Corpus luteum cysts of both ovaries Left ovary size of duck egg and intraligamentous. Both tubes closed, adherent, and contained a small amount of fluid Chronic inflammation of appendix with constriction of middle third

Examination, April 15, 1915 Graft palpable but quite small No trace of either ovary in pelvis Patient states that the graft was about the size of a hickory nut for some time and was a little tender on pressure Flashes of heat were moderately severe and began about five or six weeks after operation September 1, 1914 patient had her first menstrual flow which was profuse and lasted for one day Menopausal symptoms stopped just preceding the menstruation Menstruation recurred regularly each month, lasting two or three days, was not profuse and diminished somewhat in amount at the January and February periods No intermenstrual bleeding—no dysmenorrhoea Last menstruation about February 1, 1915 At the time of her expected period in March, flashes of heat occurred, were mild and lasted for three or four weeks (July 10, 1915, Dr Welsh reported that since September, 1914 patient has menstruated regularly and normally except the March period) The patient did not detect any enlargement of the graft preceding menstruation

CASE 17 Mrs K, age 30, referred by Dr B Almquest, Pittsburgh, Pennsylvania

Operation, June 8, 1914, by writer Dilatation and curettage, artificial laceration of the cervix, Pozzi method, bilateral salpingo-oophorectomy, myometomy appendectomy, ovarian tissue transplanted, right side

Pathology Marked stenosis of cervical canal (with obstructive dysmenorrhoea) Right ovarian cyst, size of large orange with torsion of pedicle Dermoid cyst on the left side, size of goose egg There was a small piece of normal ovary at the

outer part of this cyst but in separating the dermoid the normal ovarian tissue was deprived entirely of its blood supply. A pedunculated fibroid about one and one-half inches in diameter was attached to fundus of uterus. Appendix, chronically inflamed, a few adhesions about base. During the second day after operation patient developed a tachycardia, with pulse rate of 210. This quieted down under digitalis and bromides. About six or seven days after operation she developed a pleurisy of the left side which went on to effusion and empyema, necessitating resection of a rib. Drainage still continued from the sinus at the time she left the hospital. This has completely closed, leaving some thickening of the pleura.

Examination, March 10, 1915 Graft not palpable. Uterus small and somewhat atrophic. Patient reports that there has been no local tenderness at the site of the graft. Flashes of heat began about three months after operation, recurred frequently, each day, were quite severe and still continued but slightly less severe. No menstrual flow. Has gained about twenty pounds in weight. Patient has a definite hyperthyroidism which probably accounts for her attack of tachycardia, and also for her severe symptoms of the menopause.

CASE 12 Mrs. P., age 38, referred by Dr. W. P. McCorkle, Sheridan, Pennsylvania.

Operation, June 13, 1914 by Dr. Simpson. Vaginal hysterectomy, left salpingo-oophorectomy, right salpingectomy, extensive vaginal drainage necessary.

Pathology Bilateral pyosalpinx with small amount of pus in each tube. Left ovary cystic. Both tubes and ovaries and uterus adherent. Right ovary, fairly normal, remains.

Examination, March 10, 1915 Graft palpable but quite small, not tender. Has been no tenderness at site of the graft. Flashes of heat began February 1, 1915, are very mild and occur only in crowded places and following exertion. Less nervous than before operation.

CASE 10 Mrs. C., age 37, referred by Dr. E. P. Gray, Wilkensburg, Pennsylvania.

Operation, June 16, 1914 by Dr. Simpson. Dilatation and curettage, perineorrhaphy, salpingo-oophorectomy, left, ovarian tissue transplanted on right side.

Pathology Laceration of perineum. Ruptured ectopic on the left side with about one ounce of old blood in peritoneal cavity. Left tube and ovary adherent. Right ovary cystic, size of duck egg, ruptured but was not removed.

Examination, April 9, 1915 Graft palpable but smaller than at time of operation. No local discomforts. No symptoms of the menopause. Menstruation regular since operation.

CASE 20 Mrs. W., age 40.

Operation, July 22, 1914 by writer. Cul-de-sac incised with cautery, supravaginal hysterectomy, salpingo-oophorectomy, bilateral, appendectomy, ovarian tissue transplanted on both sides.

Pathology Bilateral pyosalpinx with small

amount of pus in each tube. Uterus, both ovaries, and tube densely adherent. Both ovaries cystic. Appendix practically normal.

Examination, March 9, 1915 The grafts are both palpable and slightly tender at times, this is increased by exertion. Flashes of heat began shortly after leaving the hospital, are moderately severe, increase under excitement. Less nervous than before operation.

CASE 21 Mrs. S., age 28, referred by Dr. J. Wilson, West Elizabeth, Pennsylvania. Appendix and outer half of right tube previously removed by another surgeon.

Operation, August 5, 1914, by writer. Dilatation and curettage, bilateral trachelorrhaphy, salpingo-oophorectomy, left, adhesions of right tube to broad ligament, and small intestine to scar of former operation, transplantation of ovarian tissue.

Pathology Left ovary cystic. Left tube and ovary densely adherent to sigmoid and parietal wall. Right ovary slightly cystic. A few adhesions about right tube. Intestinal adhesions to the appendiceal scar.

Examination, March 22, 1915 The graft is palpable but quite small. No local discomfort. Menstruation irregular as before operation, varying from three to seven weeks. Amount of flow normal. No flashes of heat. Nervous symptoms same as before operation.

CASE 22 Mrs. B., age 33, referred by Dr. J. C. Edgar, Oakmont, and Dr. J. E. Rigg, Wilkensburg, Pennsylvania.

Operation, September 24, 1914 by writer. Perineorrhaphy, supravaginal hysterectomy, salpingo-oophorectomy, bilateral, appendectomy, transplantation of ovarian tissue.

Pathology Marked incomplete laceration of perineum. Uterus retroverted. Bilateral pyosalpinx. Small quantity of pus in each tube. Both ovaries cystic. Uterus, and both ovaries and tubes densely adherent. Appendix adherent to right tube and ovary.

April 2, 1915 Dr. Edgar reports that the graft is not palpable. There is no local pain or discomfort. Has been troubled by flashes of heat. These are slight and last only for a moment. There have been no disturbances of the nervous system.

CASE 23 Mrs. R., age 40. Left tube and ovary and appendix removed two years before by Dr. Simpson.

Operation, October 2, 1914, by Dr. Simpson. Supravaginal hysterectomy, right salpingo-oophorectomy, ovarian tissue transplanted on right side.

Pathology Right pyosalpinx containing small quantity of pus. Right ovary cystic. Right tube and ovary, and uterus adherent.

Examination, March 6, 1915 Graft palpable. No local pain. Flashes of heat began shortly after operation, very slight and occur only at intervals. Much less nervous than before operation.

CASE 24 Mrs. M., age 36, referred by Dr. H. E. Clark, Sheraden, Pennsylvania.

Operation, October 26, 1914, by writer: Perineorrhaphy; combined vaginal and abdominal hysterectomy, bilateral salpingo-oophorectomy, appendectomy; ovarian tissue transplanted on right side

Pathology Laceration of perineum Bilateral laceration of cervix and marked erosion Uterus large Both tubes closed and adherent Both ovaries cystic and adherent (Patient had been bleeding excessively for a number of months)

Examination, March 4, 1915 Grafts palpable on both sides Small irregular lump projecting sharply from graft of left side, size of ordinary graafian follicle Patient states that on two occasions she has noticed enlargement of the grafts, lasted about one week, with local tenderness No pain except at that time Flashes of heat are slight and at the present time cause her little trouble Nervousness slightly increased

CASE 25 Mrs B, age 25

Operation, November 18, 1914, by writer Supra vaginal hysterectomy, salpingo-oophorectomy, bilateral; appendectomy, transplantation of ovarian tissue

Pathology Uterus retroverted and adherent Tubo-ovarian abscess of the left side, about two ounces Right pyosalpinx Right ovary cystic Large cornual nodules on both sides Both tubes and ovaries adherent Appendix adherent, kinked, contained fecoliths

Examination, April 1, 1915 Graft palpable but quite small No local tenderness Flashes of heat began shortly after operation Have been moderately severe, occurring four or five times a day but cause her little annoyance. No disturbances of the nervous system

CASE 26 Mrs Z, age 26 Two vaginal incisions and drainage were done at two different times by other surgeons but failed to cure the condition.

Operation, November 17, 1914 by writer Cul-de-sac incised with cautery, complete hysterectomy, salpingo-oophorectomy, bilateral, appendectomy, sigmoid injured in separation of adhesion, closed with catgut sutures, ovarian tissue transplanted on left side

Pathology Tubo ovarian abscess of right side size of small orange Left tube adherent and closed, contained a small quantity of pus Left ovary cystic Appendix adherent to abscess wall

Examination, March 6, 1915 Graft palpable No local tenderness Flashes of heat moderately severe, began shortly after operation No disturbances of the nervous system

CASE 27 Mrs E, age 27

Operation, November 28, 1914, by Dr Simpson Dilatation and curettage, anterior colporrhaphy trachelorrhaphy, right salpingo-oophorectomy, ligation of varicose vein in right broad ligament, appendectomy, ovarian tissue transplanted, left side.

Pathology Cystocele Incomplete laceration of perineum. Right ovary cystic, seat of constant

pain. Right tube practically normal Varicose vein of the right broad ligament, size of index finger, contained phlebolith. Left tube and ovary normal, remain

Examination, January 18, 1915 Graft palpable and about same size as at time of transplantation. Menstruation normal March 2, 1915. Graft palpable but smaller than at previous examination No local tenderness Menstruation regular and painless

CASE 28. Miss H., age 30, referred by Dr J C. Ohall, N S., Pittsburgh, Pennsylvania Uterus, left tube and ovary, and right tube previously removed by another surgeon

Operation, December 16, 1914, by Dr. Simpson. Right oophorectomy, transplantation of ovarian tissue on left side

Pathology Right ovary cystic and cirrhotic (removed on account of pain)

Examination, February 16, 1915 Patient has been in hospital until this time, under medical treatment on account of a very marked neurasthenia. During her stay in the hospital has not complained at all of any flashes of heat. On direct questioning states that she is troubled a great deal by hot flashes. Small piece of ovarian tissue palpable—not tender. It would seem that her troubles were not severe as she had made no complaint during her stay in the hospital and she was not a type to bear her troubles without complaint

CASE 29 Mrs H, age 34

Operation, December 14, 1914, by writer Supra-vaginal hysterectomy, salpingo-oophorectomy, bilateral, appendectomy, transplantation of ovarian tissue, right side

Pathology Several small fibroids in uterine wall Bilateral pyosalpinx. Ovaries both cystic Uterus both ovaries and tubes densely adherent in the cul-de-sac and to sigmoid Patient died at end of twenty six hours from a peritonitis due to the bacillus aerogenes capsulatus

CASE 30 Mrs R, age 39, referred by Dr S S Woodburn, N S., Pittsburgh, Pennsylvania

Operation, January 7, 1915, by Dr Simpson Bilateral oophorectomy, ovarian tissue transplanted on both sides

Pathology Both ovaries seat of corpus luteum cysts, densely adherent in cul de sac

Examination, April 8, 1915 Graft palpable on left side, but not on right No local discomfort. Flashes of heat severe began before leaving the hospital, but are not as exhausting as they were at first. Somewhat nervous at times but is of nervous temperament

CASE 31 Mrs N, age 45, referred by Dr F S Pershing, Wilkensburg, Pennsylvania

Operation, January 12, 1915, by Dr Simpson Supravaginal hysterectomy, bilateral salpingo-oophorectomy, ovarian tissue transplanted, right side

Pathology Multinodular uterine fibroid size of grapefruit Left ovary cystic, two inches in diam-

eter Blood supply of right ovary was impaired and ovary was removed on that account

Examination, April 10, 1915 Graft palpable, about same size as at time of transplantation. No local tenderness Flashes of heat are very slight and occur only when tired No disturbance of the nervous system.

CASE 32 Mrs A, age 35, referred by Dr. D W B. Martin, Pittsburgh, Pennsylvania

Operation, January 27, 1915, by Dr Simpson Pnenorrhaphy, right salpingo-oophorectomy, removal of hæmorrhoids.

Pathology Marked laceration of perineum Right ovary cirrhotic and cystic, size of hen's egg, has been very painful Left tube and ovary normal, remain. Appendix previously removed Two hæmorrhoids removed by clamp and cautery

Examination, April 8, 1915 Graft palpable, about original size No variation in size has been detected by patient No local discomfort Menstruation has recurred every five weeks, regularly for this patient No flashes of heat or nervous disturbances

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and the next uterine contraction forces this blood, like a fluid wedge, between the layers of the decidua serotina, separating the placenta in a smooth manner. This accumulation of retroplacental blood is added to during each period of relaxation and spreads out with each contraction, thus separating more and more of the placenta from its central portion toward the periphery. This blood is retained normally behind the placenta owing to the firm attachment of the membranes where they are deflected from the placenta to the uterine walls. The placental circumference is the most firmly attached portion because of this peripheral attachment; and unless the uterus is manipulated and the blood forced through at some point in this circumferential adhesion, the normal mechanism of separation obtains. Retraction of the uterine muscle closes the sinuses in the placental site, the muscle-bundles crowd closer together, the several layers slide over each other, and so bend and twist the sinuses on themselves as to choke the blood current, and so check hæmorrhage. Normal contraction and retraction always coöperate, and, together with the retraction of the irregularly torn vessels and the increased coagulability of the blood, do the actual work of uterine hæmostasis.

The placenta thus separated, unless it be located in the lower segment of the uterus, and our experiences show that the majority are attached high in the body of the uterus must necessarily be delivered by its foetal surface, with the cord coming first, more or less simulating the method of expulsion described by Schultze. Nature has further fortified the healthy woman against loss of blood attendant upon normal expulsion of the placenta, by an overproduction of blood during pregnancy, the total quantity of blood is actually increased, the fibrin is greater in amount, and a leucocytosis is present during labor. It is therefore difficult, after studying the provisions and safeguards with which Nature has fortified a woman against loss of blood during labor, to see how the normal processes can be improved upon. And we believe with Ahlfeld that the physiological separation of the placenta is hastened if the uterus is not handled

after delivery, and, further, that active intervention, as uterine manipulation, favors retention of the placenta and membranes by interfering with those physiological processes. Manipulation tends to force the retroplacental blood before it has had time to collect, and completely separate the placenta, through the attachment of the membrane at some point in the placental circumference, and thus ends Nature's process. This produces partial detachment of the placenta with incomplete retraction and contraction of the placental site. *Incomplete separation and incomplete retraction* allow uterine bleeding, for it is admitted by all authorities that when the placenta is situated, as it usually is, in the upper segment of the uterus, there can be no apparent vaginal hæmorrhage until separation takes place. Our experience convinces us that premature efforts with the Crèdè maneuver before the clinical evidences of separation are apparent disturbs the normal mechanism.

There seems to be a confusion in the minds of practitioners between adhesion of the placenta and retention. These are distinct entities. Retention, as has been shown, occurs with varying frequency, depending upon how closely the physiological changes of the placental stage are observed. The placenta is frequently retained in the dilated lower segment of the uterus and cervix after it has been detached from its original site. Adhesion, on the other hand, is extremely rare, occurring in but one of the two thousand cases studied. In adhesion there is a penetration of the myometrium by the chorionic villi, the villi burrowing down into and between the muscle-fibers, intimately attaching the two structures and small round tissue cells are deposited in the intermuscular spaces, substituting fibrous for muscle tissue — *the meshy layer is wanting or anomalous*, making the placenta part of the uterine wall.

From the foregoing study we would make the following deductions as to the management of the placental stage and the treatment of adherent placenta.

- 1 That the placenta will separate spontaneously if the normal mechanism is allowed to obtain

2. That any manipulation of the uterus before the clinical evidences of separation are apparent disturbs this normal mechanism.

3. That post-partum hæmorrhage is best guarded against by the observance of the physiological processes, and that partial detachment, the result of manipulation, predisposes to bleeding.

4. That the normal mechanism of placental delivery is that described by Schultze.

5. That the Duncan mechanism of expulsion only occurs in low implantations of the placenta and where manipulation has been untimely and vigorous.

6. That the placenta may be retained in the uterus for hours or days without danger to the patient, provided it is attached or completely detached, which insures that the bleeding will be negligible

7. That sepsis is dependent upon the penetration of the uterus by the hand or in-

strument through infected passages, and not upon the retention of the placenta.

8. That manual extraction *is only admissible in partial separation with hæmorrhage.*

9. That in retention of the placenta without hæmorrhage the cord should be cut off close to the cervix and the case watched until the signs of separation are apparent, when the placenta may be expressed by Credé while the patient is under surgical anæsthesia.

10. That invasion of the uterus via the vagina is fraught with danger from infection; and on exploration, should the placenta not be found presenting at the internal os, infrapelvic delivery should be abandoned and delivery accomplished through sterile avenues by suprapubic extraperitoneal hysterotomy.

11. When the adhesion is so great that its removal entails the *digging out, piecemeal*, of the placenta, excision of the placental site or hysterectomy should be our choice

HAIR BALLS, OR HAIR CASTS, OF THE STOMACH AND GASTRO-INTESTINAL TRACT¹

WITH SPECIAL REFERENCE TO THEIR PRE-OPERATIVE DIAGNOSIS BY RADIOGRAPHIC METHODS OF INVESTIGATION, AND A REPORT OF A LARGE HAIR CAST OF THE STOMACH SUCCESSFULLY REMOVED BY GASTROTOMY

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THE presence in the human stomach of a hair ball, hair cast, trichobezoar or phytotrichobezoar (when vegetable fibers are mixed with the hair), or egaropiles ("sheep's wool")—as these masses have been variously termed—though infrequent, has ceased to be a very rare condition, over 73 cases having appeared in the literature since M. Baudamant (1) reported the first specimen of this kind in the *Journal de Médecine*, Paris, in 1779.

My colleague, Dr. W. W. Butterworth (2), in a most interesting and valuable paper contributed to the pediatric section of the American Medical Association in 1909, was able to compile and analyze a total of 42 cases, including one personal observation, which, after a thorough bibliographic research, he was able to find in the literature up to that year.

Dr. G. A. Moore (3), of Boston, in reporting an interesting case of hair cast in the stomach in the *Boston Medical and Surgical Journal* for January 1, 1914, after a fairly extensive search, found 53 cases mentioned in the literature.

The latest contribution by Dr. Ledra-Heazlitt (4), of Auburn, N. Y., which appeared in the *Journal of the American Medical Association* of January 10, 1914, increases the list to 70 reported cases. These reports include hair tumors throughout the gastro-intestinal tract found on necropsy as well as by operation. Desiring to isolate the cases discovered by operation, Dr. Heazlitt, in reviewing the literature, has collected 41 cases. If to these we add a second case reported by C. Thurston Holland (5), of Liverpool, and a case successfully operated on by Treplin (6), as well as the present instance (all reported in the course of the current year)

there would be at least 73 reported cases, of which 44 have been operated upon since Schoenborn (7) first removed a tumor of this kind by operation, in 1883.²

Of these, 38 cases were gastrotomies for hair balls which, in several cases—as in our own—were prolonged into the duodenum; 4 were enterotomies, or intestinal resections in which one or more hair balls were found in the small intestines, chiefly the ileum; while in two others, both gastrotomy and enterotomy were performed on the same patient for separate hair tumors—the operation having been performed at different times in both instances (Heazlitt, 4).

The habit of hair swallowing appears to be practically confined to females. Of the 44 operated cases, all occurred in either girls or young women, except one, the youngest being six years of age (Treplin's (6) case, 1914), and

¹Since the reading of this paper on December 15, 1914, Dr. W. C. Carroll (8), of Rochester, Minn. (*Journal of the American Medical Association*, January 15, 1915) has reported an additional successful case operated on by Dr. Charles H. Mayo in which the existence of a gastric hair ball was revealed in the course of an exploratory operation to clear up an obscure diagnosis of abdominal tumor. A hair ball was considered as one of the possibilities but no X-ray examination was made. The patient was a girl, aged ten years. The operation was performed June 11, 1914. The hair cast weighed 3 pounds and measured 25 x 25 x 7 cm. The patient made an uneventful recovery. The operation was mentioned by Dr. Mayo in the discussion of this paper. He also referred to a successful gastrotomy for hair ball which had been reported by Dr. Rydberg of Uppsala, Sweden, in which the pre-operative diagnosis with X-rays had been made. I gathered from Dr. Mayo's remarks that the patient had been exhibited to him and other American surgeons who were visiting the Uppsala clinics in the summer of 1914.

Dr. Wilson Martin (9), of New York, presented a woman aged twenty-four years at the meeting of the New York Surgical Society April 22, 1914 (*Annals of Surgery*, 1914, 6, 764) from whose stomach he had successfully removed (a few weeks previously) a large hair cast. The pre-operative diagnosis of hair cast was made by the radiologist, Dr. LeWald, the fluoroscopic image being similar in every way to that described by Dr. Thurston Holland (5) whose method and interpretations are frequently quoted in this text. The patient admitted the hair-eating habit.

Dr. Martin's case would be the eighth recorded in which the diagnosis of hair ball in the stomach has been made by a preliminary X-ray examination. Kampmann 1912 (10), Huttenbach 1912 (11), Ramsbottom and Barclay 1913 (12), Holland 1914 (5), K. Schwartz, 1913 (13), Francke-Lehmann 1914 (14), Læhrhorn 1914, Martin and LeWald 1914 (9).

If we add the cases reported by Mayo, Ekborn and Martin to those mentioned in the text, there would be a total of 76 reported cases of gastro-intestinal hair balls or casts of which 47 have been operated on with a death or a little over a percent, including in the 2 enterotomies. It is probable that if a careful canvass were made among the surgeons of the day many unreported cases would come to light which would swell the statistics very considerably.

² Read before the Southern Surgical and Gynecological Association, Asheville, North Carolina, December 15, 1914.

the oldest, a man, aged fifty-two years (Kooghen's [15] case, 1883). In most instances (75 per cent, Butterworth, 2) where a history was obtainable the habit had existed from early childhood and had continued over a period of several years "Once it had existed thirteen years (Schulten's [16] case), in another, fifteen (Best's, 17), seventeen in a third case (Russell, 18), and twenty-two years in a fourth (May, 19)." In our own case the habit had probably existed for fourteen years. The greater number have preferred their own hair, either pulling it out and swallowing it, or chewing the ends of the braids or curls, but occasionally swallowing, in addition, such articles as bits of string, cotton, wool, etc., which have formed a nucleus for the hair tumor. In only two instances (Heazlitt, 4) has hair from a foreign source been removed. One patient a woman spinner of cow's hair, was in the habit of moistening her fingers with the tongue, and thus swallowed enough to form a spherical hair ball in the stomach, weighing about four ounces. The other patient, a woman, aged thirty seven years, a brush maker by trade, ate the bristles used in making the brushes, and the hair tumor was composed of this material.

In the majority of the cases it is not clear why the perverted habit leading to hair eating existed. One who is familiar with the pica or bulimia or earth and clay eating which is so common a feature in the history of infantile uncinariasis, is surprised that hair balls are not more frequent in the hookworm infested districts of the South and the Tropics, but evidently the appetite for dirt or earth of the hookworm victim does not extend to hair. In fact, as Butterworth (2) remarks it is not noted that the presence of intestinal parasites has played an important part in its etiology, for he could find only two such instances, his patient, a girl, aged eight years, a native of Mississippi, who succumbed to the effects of a large hair ball, combined with those of chronic uncinariasis, before any operation could be performed for her relief, and one of Quam's (20) of London, presumably a helminthiasis, not of the hookworm variety, however. A third is the sub-

ject of the present observation, a native of Alabama, who for years had been the typical victim of the hookworm disease. Contrary to general belief, insanity or mental derangement does not appear to play an important part in the causation of the habit, in fact, only 4 patients in a list of 73 gastric hair balls, appear to have been insane and in these, with one exception, other substances besides hair, such as nails, tacks, leaves, cocoanut fiber, and twine, were the chief components of the gastric bezoars. It is probable, as Butterworth (2) justly remarks, that the custom of young girls wearing their hair long, loose, and flowing over the shoulders, is an important factor in favoring the establishment of the practice of biting the hair, or passing strands through the mouth or between the teeth. This is most likely the reason why a hair bolus is practically confined to the female sex, and accounts for its greater frequency at an age corresponding to the period of a girl's life when her hair is worn long and loose. Biting hair and swallowing it is, in this respect, analogous to the habit of biting the finger nails, which is common to both sexes in the early childhood and adolescence, the hair eating preponderating in women solely because of the greater opportunity and temptation offered by the long hair of the girl.

The most frequent situation of these hair balls is in the stomach. It is relatively rare for these to be found in the bowel. In only 6 of the 44 operated cases were hair balls found in the intestinal tract (Heazlitt, 4). The tumor usually consists of a large accumulation of hair of varying length, firmly matted into a hard mass, which often completely fills the cavity of the stomach and is shaped by its walls into an exact cast of the organ. The general contour of the hair ball of the stomach, when fully developed, corresponds to the shape of the letter J, thus reproducing the normal stomach outline as disclosed by the fluoroscope or radiograph. The hair masses may occasionally be multiplied or joined by faceted surfaces. "In animals, it is not unusual to find a number of hair tumors at the same time in the stomach." One writer, quoted by Nathan Jacobson (21),

speaks of as many as 9. Holland's (5) second case, illustrated in this article, shows three distinct divisions in the X-ray picture. These are so molded to each other that together they formed a perfect cast of the stomach. They are not infrequently prolonged, as in the present case, by processes that extend into the duodenum or, more rarely, into the esophagus. In only 1 case (Gemmel's, [22], 1894) was a hair ball localized exclusively in the esophagus, a part of which projected into the stomach. This was an insane man, aged forty-three years, in whom a gastrotomy revealed the presence of 192 nails, pieces of screw, a brass wire, carpet tack, several small pieces of stick, and the above mentioned hair ball which was removed from the esophagus. Just why more tufts of hair, which must be ingested in small quantities at a time, do not pass through the bowel, is not always clear. One assumption is, that the individual bits of hair reaching the stomach are caught in the mucous folds and thus retained, and that subsequent additions gradually attach themselves to the primary nucleus in the formation of the mass. The movements of the stomach of the carnivorous animals have been recently more thoroughly studied with the help of X-rays. Dr Cannon (23) administered different quantities of bismuth with food and, after giving it to a cat, made a series of X-ray pictures of the stomach while the process of digestion proceeded. It appears that the food is crowded onward from the cardiac to the pyloric end by rapidly recurring peristaltic waves, and that the stomach contents when filling this organ, are compressed by its muscular contraction and perfectly molded to conform with the interior of this organ. And so we must assume that when a foreign substance, like hair, steadily accumulates and ultimately fills the stomach it is similarly acted upon and receives the imprint of the contracted organ. Instead of a "hair ball," we have, therefore, a "hair cast" of the stomach (Jacobson, 21).

Hair balls and hair casts of the stomach often attain large proportions. According to Butterworth (2), one of the smallest (Pelliderton's, 24) weighed, dry, two and a

quarter ounces, or about one-third of its original weight. Several were over two pounds, as in our case. O'Hara's (25), Baudamant's (1), Dandois' (26), and Swain's (27) weighed five pounds three ounces, while Mermet de Hautville's (28) is reported to have weighed about six pounds, which after nineteen days of desiccation weighed two and one-half pounds.

The clinical history of these patients is fairly well illustrated by the subject of the present observation. It is remarkable, as Butterworth (2) states, how little the general health suffers, considering the duration of the habit. Eventually the limit of toleration is reached, and nature protests. "Pain is a fairly constant symptom; vomiting, at some time or another, is usual, and yet, considering the spongelike and absorbent character of the hair cast it need occasion no wonder if vomiting does not occur. This is readily understood when we realize how ineffectual must be the effort of the stomach to empty itself, when it is literally filled with a mass which is not only molded to its walls, but is itself an effective obturator or plug applied to the esophageal opening. Hematemesis is comparatively rare, while dyspepsia and abdominal tumor are usually the earliest symptoms. It is rather surprising that ulceration is not reported more frequently.

According to Woldfer and Leiblin (29) in their monograph on foreign bodies in the gastro-intestinal tract (1909), only 5 cases of hair ball in the stomach, causing ulceration of this organ, have been reported. Butterworth (2) and Clairmont (30), have each added one case, making in all, as far as I know, 7 cases. Of these, 6, including Butterworth's (2) case, ended in perforation and death. The ulcer, in all of these, occupied the greater curvature, only in the seventh case (Clairmont's, 30) was the lesser curvature the seat of the ulceration. This operator, after removing the hair ball from a girl, aged eight years, found it necessary to resect a large ulcer of the lesser curvature by a gastrectomy which involved one third of the stomach. The patient made an uninterrupted recovery.

"Alternating attacks of constipation and

diarrhoea are the usual rule. Eventually the breath becomes exceedingly offensive; anaemia grows more pronounced, ingestion of food more difficult, emaciation and exhaustion more noticeable and, unless surgical measures are instituted, with rare exception death occurs from inanition or perforation."

The history of these tumors only illustrates the extreme tolerance of the stomach to foreign bodies and its wonderful adaptability to the most disturbing mechanical obstacles in the normal exercise of its function.

The operative treatment of these hair masses in the stomach has contributed one of the most brilliant chapters to the history of gastric surgery. In 38 gastrotomies reported, not a single fatality has occurred. Only 2 cases in the series of 41 operative cases died including enterostomy (Heazlitt, 4), and these fatalities occurred when the operations were performed on nearly moribund children suffering from advanced obstruction due to hair accumulations in the ileum. (See last paragraph of footnote, first page of article.)

The technique of the gastrotomy for the removal of hair ball does not differ essentially from that which is applied for the removal of foreign bodies from the stomach in general, with the exception that the incisions required on the anterior surface of the organ, midway between the lesser and the greater curvature, are often of unusual length in order to dislodge and extract the enormous mass without traumatizing the stomach wall unnecessarily. More than usual care is also required in the intraperitoneal exclusion of the cavity, as it is often impossible to deliver the enormously enlarged stomach and extraperitonealize it to insure the most perfect asepsis. These masses are usually so foul and putrid, as the result of long-standing fermentation and decomposition of the hair masses, which are mixed intimately with the residue of food of all kinds, that great care is required to prevent the contamination of the peritoneum and abdominal walls with the drippings from the thick, slimy ooze that covers them. The odor emanating from these masses is so putrid and malodorous that even after weeks of immersion in preservative solutions of formalin and other antiseptics the nauseating odor

still clings to them as is well illustrated in the present case. However it is evident that, by the ordinary exercise of caution, in the hands of experienced surgeons, the risk of contamination and peritonitis has been successfully met, as shown by the uniform success and freedom from mortality which has attended the operations thus far recorded.

The indications and success of the surgical treatment of this condition having been clearly and firmly established the chief interest in the clinical study of these cases lies in the pre-operative diagnosis.

THE PRE-OPERATIVE DIAGNOSIS

It is to this feature of the subject that I wish to direct special attention. From this point of view the mere presentation and exhibition of these cases in medical societies is profitable, as the description of an actual occurrence and the exhibition of such a striking specimen as the one here shown will be of benefit in reminding a puzzled diagnostician of one of the possibilities he might have overlooked in the analysis of a doubtful and problematic case. The obscurity of the diagnosis in gastroenteric trichobezoars is well attested by the fact that of the 47 cases in which an operation was performed in only 10 was a correct diagnosis made before operation. In the majority of cases, simple exploratory laparotomies were performed for tumors of admittedly unknown origin. In others, various conditions were suspected, such as floating kidney, movable spleen, omental tumors or hydatid cysts, tuberculous peritonitis, or malignant growths of the stomach. In one case the hair tumor was supposed to be a twin pregnancy. Until the advent of systematic X-ray examinations the nearest approach to a pre-operative diagnosis has been a gastric tumor. The history and antecedents are often useless, as the patients for the most part, fail to describe their habits or deny them altogether. Even when the suggestion of hair swallowing is offered, it is indignantly repudiated. It is only when confronted with the corpus delicti itself, after the operation, that the patient will admit the habit. The first to record a positive diagnosis prior to operation, accord-

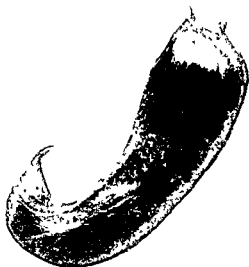


Fig 1 Photograph of hair cast removed from the stomach of Miss M. B. by gastrotomy, on May 22, 1914 (Dr. Matas' case). Weight of dry specimen, 2 pounds $\frac{3}{4}$ ounce (about 667 grams), greatest length along greater curvature, 18 inches (46 cm.), along lesser curvature, 9 inches (23 cm.), greatest circumference at fundus, 10 $\frac{3}{4}$ inches (27 cm.), at terminal part, duodenal end, 6 $\frac{1}{4}$ inches (17 cm.). All measurements were taken from the dry specimen.

ing to Wolfier and Leiblin (29), was Stelzner (31), in 1886, who diagnosed a hair ball in the stomach, in spite of the patient's denial, because the tumor could be moved to and fro like a billiard ball in the dilated stomach. But, even with this evidence before him, Stelzner (31) would probably not have been certain of his diagnosis had he not had Schoenborn's (7) case in mind, which had been previously reported in *Langenbeck's Archiv*, 1883. Paton (32), in 1902, made the second correct diagnosis on the information that the girl was known to be a hair swallower and had already vomited a hair ball, also in Ranzi's (33) in 1904, the pre operative diagnosis of hair ball was stated as very probable, and likewise in Harvie's (34) case in 1908, because the child had been in the habit of swallowing hair and woolen thread. A correct diagnosis was also suggested to Scott Turner (35) after a hair tumor had been removed some weeks previously from the bowel of the

same patient. As far back as 1886, Knowsley Thornton (36) came very near the truth in assuming that the transverse colon was the seat of a hair ball in his patient, because it had been noticed that hairs were passed in the stools, and gastric symptoms were absent. At the time of the operation, however, the hair ball was discovered in the stomach. Before the hairs were discovered in the stools, the tumor was regarded as a fecal mass. In the vast majority of the earlier cases, the tumor was only recognized at necropsy or at operations performed under a mistaken diagnosis.

In many cases the physical signs alone, in view of the slight gastric disturbance, must furnish the basis for the diagnosis. It should be remembered that hair balls are limited and usually well defined, hard, painless tumors, situated in the upper abdomen, where they assume different forms according to their stage of development, and are, therefore, variously described as gourd-like, cucumber-shaped, sausage-shaped, J shaped, oblong or spherical masses. They are scarcely, if at all, tender on palpation. The tumor is also characterized by considerable mobility, often in all directions but especially toward the left costal arch.

In the cases in which the tumor does not fill the stomach the relation of the mass to the gastric wall, after insufflation with air, is important. In this way the tumor can be shown to lie in the stomach. On palpation the tumor can be felt and separated by a layer of air from the abdominal wall. Gastric lavage, in cases which do not fill the stomach completely, may bring out strands or pieces of hair in the washings, but all these signs are very uncertain and unless the suggestion is offered by a previous history of hair swallowing (trichophagia), the diagnostician is likely to overlook the real nature of the gastric mass.

The radiologic diagnosis. It is only very recently, and since the roentgen rays and fluoroscope have been so advantageously utilized in the study of gastro-enteric diseases that a great step forward has been made in the diagnosis of hair balls, as well as of other foreign bodies in the stomach. A number of recent writers have directed attention to the

value of X-rays and fluoroscopic examinations in cases of hair balls. Notable among these contributions are the case reports of Kampmann (10), Huttenbach (11), Clairmont and Handek (30), Schwartz (13), Francke (14), Ramsbottom (12), T. Hausmann (37), and, especially, of C. Thurston Holland (5).

Kampmann (10) in 1911 reports the case of a girl, aged ten years, in whose gastric region a smooth rounded tumor, the width of a hand, not tender on pressure, could be palpated. The mass could be displaced upward and laterally, and could be outlined by percussion upon the nipple line from the upper to the lower gastric region. The history, with the presence of hair in the stools, pointed to the diagnosis of trichobezoar, but Kampmann emphasizes the advantages of the X-ray examination, after the preliminary administration of a bismuth meal, which, in this case, rendered the tumor distinctly visible as an *intra*gastric mass.

Huttenbach (11) in 1912 reports a case in which a large mass was observed below the xiphoid cartilage, which was visibly displaced up and down on respiration, at the site of the tumor, causing a distinct protuberance on the abdominal wall. The mass could be readily palpated, extending from the left to the right hypochondrium. The tumor had the shape of a greatly enlarged stomach, although the lower boundary did not present a uniformly convex surface. Radiography on an empty stomach furnished little diagnostic information, as no sharp shadow contrasts appeared in the abdomen, but a radiograph taken after a "contrast meal" showed dark shadow lines which outlined the contour of a lighter mass in the center of an enormously dilated stomach. The "magenblase" or upper air space of the stomach was entirely absent. The author concludes that the radiographic or fluoroscopic examination of the stomach *after* the administration of a bismuth or other contrast meal is the decisive element in the diagnosis of trichobezoar.

The radiographic diagnosis of hair balls is made the subject of a special discussion by Clairmont and Handek (30) in 1911 in a paper in which they reported such a case. A smooth, thick, resisting mass, having the



Fig 2. Retouched radiograph of Miss M. B. (Dr Matas' case). Hair cast in the stomach showing Holland's characteristic "J" shaped shadow occupying the entire gastric area enclosed within the gas-distended loop of the transverse colon. No contrast meal. Exposure two seconds with screen. (From the X Ray laboratory of the Toussaint Infirmary, New Orleans.)

configuration of the stomach and slightly sensitive to pressure, could be palpated in the patient's left hypochondrium. The tumor was freely movable, had a rounded contour under the left costal arch, which tapered outward toward the pylorus. In the fluoroscopic examination, with the patient in the upright position, the tumor in the gastric region, which was movable, could be displaced upward until it obliterated the upper air space of the stomach (magenblase), where it formed a dense shadow which somewhat resembled a kidney. The "contrast meal" did not penetrate into the stomach in the usual way, but entered very gradually spreading along the lesser curvature, it then diffused itself in a much larger streak along the fundus and greater curvature, in this way outlining a large central mass, which was evidently

detached and separated from the gastric wall. The diagnosis of the gastric tumor was arrived at by the evident presence of a mass which nearly filled the stomach space, and the diagnosis was further advanced to an *intra*gastric foreign body on account of the unusual mobility of the tumor, which could be pushed out by palpation from the greater curvature to the cardiac extremity, where its upper end was made visible against the clear air space.

K. Schwartz (13) in 1913 reports the removal of a hair ball from a girl, aged seventeen years. The mass weighed 941 grams. In this case the examination of the stools for hair proved positive. The X-ray examination was difficult, because the patient was nauseated after the first barium dose and refused further doses. Nevertheless, the few doses swallowed were sufficient to obtain with great distinctness the following picture: the greater curvature of the stomach, which corresponded entirely with the visible and palpable lower boundary of the tumor, was sharply outlined by the dark shadow contours caused by the opaque meal. The pre-operative diagnosis of hair ball was fully confirmed by the operation.

Another patient was operated upon by Francke (14) in 1912, and was presented by Lehmann to the Röntgen Congress of 1914. In this case a hard, round, painless tumor was detected in the gastric region. The radiograph showed an uneven, spotted lighter area, which filled nearly the entire stomach, and was especially well outlined above a distinctly visible arch. On the basis of the clinical history combined with the radiographic findings a probable diagnosis of hair ball in the stomach was made which was fully confirmed by the operation.

T. Hausmann (37) in 1914, describes a hair ball of the stomach in a girl aged fifteen years. At the time of the X-ray examination a peculiar behavior of the gastric shadow was noted. It appeared diffusely blurred, a dense, dark streak being seen only along the sharply outlined greater curvature of the stomach. This blurred portion corresponded to the hair ball, in the meshes of which bismuth had become imbedded, the dark portion

was the free marginal portion of the stomach in which bismuth alone was deposited. This behavior of the gastric shadow was noted only with the patient in the recumbent position. It was furthermore noteworthy that the X-ray findings were suggestive of gastrectasis, while the clinical signs of stagnation were absent. These signs are regarded by the author as important indications for the diagnosis of hair ball. Although the diagnosis of hair ball was not made by the writer (Hausmann, 37) nor by others who had seen the patient (the pre-operative diagnosis was tumor of the spleen), the author lays stress upon three new signs, to which he attaches special importance in the diagnosis of gastric trichobezoar.

1. The characteristic behavior of the greater curvature on palpation, i.e., the greater curvature of the stomach becomes palpable when the stomach is contracted in active peristalsis and the bezoar is gripped firmly by the muscular contraction. It is not palpable when the stomach is relaxed and does not grip the foreign body.

2. The presence of fatty acid plates and needles in the contents of the fasting stomach, and the absence of starch and muscle fibers. (These peculiar findings were not explained until the operation, when the hair ball was found to be infiltrated with fat which had resisted the digestive juices of the stomach and had been caught mechanically in the meshes, while the starchy and albuminous substances were digested and discharged out of the stomach.)

3. The revelations of the fluoroscopic screen or radiograph when a bismuth meal was administered, which distinctly proved the *intra*gastric position of the tumor.

The spontaneous (peristaltic) displacement of the tumor, which was pointed out by Schreiber (38) in 1896 as of diagnostic value, may occur also in other movable tumors, according to the variable contractility of the stomach or intestines. It is of no special diagnostic significance in hair ball, and is, in fact often absent.

But the special features and proper interpretation of the fluoroscopic image and radiographic picture of hair ball have been

presented with far greater clearness in the later observations of Ramsbottom and Barclay (12) and C. Thurston Holland (5). Ramsbottom and Barclay (12) believe that theirs is the first case that has been absolutely and definitely diagnosed by this means. In this case, a woman, aged twenty eight years, the X-ray examination showed the existence of a hair ball. The operation which followed proved the accuracy of the pre-operative diagnosis, which was so complete that not only was the nature and shape of the tumor predicted, but also its size, which was given as 9 inches long by 3 inches in width. "The examination was conducted with the patient in the erect position, the bi-smuth meal flowed at once into the stomach and began to canalize down the greater curvature. Presently, as more food was given the shadow extended along the lesser curvature, apparently around the mass which was evidently, therefore, not to the inner side of the stomach but either *inside in front* or *behind* it. A little manipulation and rotation of the patient quickly demonstrated that the mass displacing the bi-smuth (showing as a lighter area in the midst of the dark shadow of the bi-smuth) was actually *within* the stomach. By means of palpation it was easy to demonstrate that it was freely movable within the stomach. The tumor could be displaced the top of it rising above the level of the bi-smuth food and showing as a rounded shadow in the clear air space in the fundus of the stomach. In order to demonstrate the nature of the tumor still more clearly the fundus of the stomach was distended with CO₂ and into the larger gastric vesicle thus obtained the hair ball was pushed up. It gave a heavy shadow because of the coating of bi-smuth it carried up with it.

C. Thurston Holland (5) reported in 1913 and 1914 two cases of hair ball in the stomach which from the radiographic point of view are of great interest and value. In the first case in spite of the suggestiveness of the picture the exact diagnosis of the true nature of the gastric tumor was only mentioned but not definitely stated. In the second case the exact diagnosis was made and stated definitely before the operation. This second

case (1914) may be summarized as follows from Mr. Holland's report:

A girl, aged sixteen years, was referred to Mr. Holland for radiographic study. The history was that she had a very large abdominal tumor for eleven years. This had been diagnosed at various times by several medical men as a tumor of the spleen, liver, or kidneys. Operation had been suggested, but as no definite diagnosis had been made the mother refused to allow one. For five or six years 'up to a year ago' there had been a constant vomiting of food. This had stopped twelve months ago but lately had started again. There was no pain, but some tenderness in the upper right abdomen.

Holland (5) writes: "With a vivid recollection of my first case, the diagnosis appeared quite certain and I made a definite diagnosis of hair ball in the stomach before the X-ray examination. The tumor presented itself as a large, hard mass curving down from below the left costal margin. The right border was quite smooth and curved down with an even edge to two inches below the umbilicus then turned upward to the right to disappear under the lower edge of the liver. It was very hard and there was tenderness just beneath the liver to the right of the median line. The whole lower part could be grasped between the hands and then the tumor could be swung from side to side of the abdomen as if suspended from a fixed point behind the upper left costal margin. The history was then discussed more fully with the mother and the fact elicited that no one had ever suggested to her any other diagnosis except that of tumor of the spleen, liver or kidneys—these were the mother's own words. I then asked a direct question: 'Are you sure that no one has ever suggested to you that the tumor consisted of hair?' The answer was significant.

No, but now that you mention hair I remember that when she was four or five years of age she used not only to bite off her own hair but also in her sleep to pick off and chew bits of blanket.

The radiographic appearances in this case as given by Mr. Holland are so characteristic that they are worth quoting for the guidance of other observers.

"1. Before any food was given it was possible to make out the general shape of the tumor on the screen and to differentiate it from the liver as it was thrown into relief by the gas-distended transverse colon. (The plate which shows the radiographic image in my case see Fig. 2, contains perfectly with the observation of Mr. Holland. The gas-distended transverse colon completely outlines the contour of the stomach which appears as a dark shadow caused by the dense hair mass.)

"2. The first few mouthfuls of liquid barium meal remained held up in the cardiac end of the stomach and spread out as if forming a cap to whatever was inside of the stomach. (C. T. Holland's second case Fig. 1.)



Fig. 3 Radiograph of Dr. C. F. Holland's second case of hair ball in the stomach. "The first few mouthfuls of liquid barium meal remained held up in the cardiac end of the stomach and spread out as if forming a cap to something inside of the stomach" (from the *Lectures of the Konigen Ray*, March, 1914 plate 437 By kind permission of the publishers)

5 Shortly after swallowing a breakfast cupful of the food the whole stomach was mapped out by what was obviously the barium lying between the walls of the stomach and the less opaque mass filling it (Holland's plate, Fig. 4)

"It was then obvious that an enormous mass — the hair ball — filled the entire stomach right up to the pyloric end, the J shape being most beautifully shown"

"A few days later, Mr. Newbolt removed a large hair ball, 10 inches in length, which weighed two pounds 12 ounces. The patient made an excellent recovery"

From these general observations we may conclude that the pre operative diagnosis of hair ball is possible and not difficult if the following facts are borne in mind

1 That over 90 per cent of hair balls occur in girls or young women

2 That a careful interrogatory as to habits in childhood or puberty will often give a suggestive clue to the hair eating habit

3 That the examination of the stools frequently reveals particles or strands of hair, and that lavage of the stomach will bring up particles or detached strands of hair

If these preliminary facts can be obtained the pre operative diagnosis only needs confirmation by the physical and radiographic examination which should show (a) a shadow in the region of the stomach (epigastrium) of a characteristic J-shape (Holland, 5) fringed at its lower border by a crescent lining formed by the gas-distended transverse colon. This will (b) localize the gastric area and exclude the spleen and omentum, as these lie outside of the colonic loop. The liver can usually be distinguished from the stomach area by a faint darker outline. The further differentiation is accomplished by

4 Administration of a contrast meal of bismuth or barium in suspension, which will, at once, isolate the hair ball, either by surrounding it completely, leaving a paler and fainter area wherever the mixture has failed to penetrate the hair mass, or in large hair balls, by the differentiating fluid finding its way between the stomach wall and the tumor. A distinct gastric contour is thus obtained within which the intragastric mass is defined by the gradual spreading of the contrast material on the outer surface of the hair ball. Or if this consists of two or more segments, as in Holland's (5) first case, by the penetration of the contrast fluid into the interspace which subdivides the mass (see Fig. 5)

5 Finally, while the progress of the bismuth or barium meal is being watched, the displacement of the intragastric mass can be observed as it is moved upward or sideways by manipulation. If the displacement of a foreign body within the stomach can be made out clearly and unmistakably, and the mass is more or less molded on the contour of the stomach, it is almost impossible for the mass in the stomach to be anything else than a hair ball

The real difficulty in the diagnosis of these cases lies in the usual inadvertence or unpreparedness of the operator for the possible presence of a hair ball — the condition being



Fig 4 Radiograph of Dr. C. T. Holland's second case of hair ball in the stomach. "Shortly after swallowing a breakfast cupful of the contrast meal the whole stomach was mapped out by what was obviously the barium lying between the walls of the stomach and the less opaque mass filling it" (from the *Archives of the Rontgen Ray*, March 1914, plate 437. By permission of the publishers.)

so rare that it is scarcely considered or thought of unless the operator has had his attention directed to it by previous experience or personal knowledge of other cases. From this point of view alone the presentation and discussion of these cases is valuable and should be encouraged in medical societies. In the past when radiographic investigations were not available, it was never possible to make a pre operative diagnosis except by the suggestiveness of the previous history or the presence of hair in the vomit or in the stools. At present, with a constantly improving fluoroscopic and radiographic technique everywhere available, it would seem almost impossible to miss the diagnosis whenever the resources of the X-ray examination are systematically applied.

AUTHOR'S OBSERVATION

The subject of this observation, Miss B., aged nineteen years, of Geneva, Alabama, was admitted,



Fig 5 Dr. C. T. Holland's first case of hair ball in the stomach. The radiograph shows a hair cast formed of three parts. The upper and lower masses articulated with the center one by smooth faceted surfaces. (from the *Archives of the Rontgen Ray* July 1913, plate 417. By permission of the publishers.)

by recommendation of her family physician, Dr. Chapman, to the Touros Infirmary, on May 5, 1914. She is a pale, emaciated girl, who, though nineteen years of age, has never menstruated. She is intelligent and in every way a sensible young woman, but has been sickly since her earliest childhood. Her parents are dead, both died of cancer. Apart from this fact there are no antecedents of special importance, except that she was infested in her childhood, like a great many people in her section of the country, with hookworm. An older sister who accompanies her added very little to her early history, and recalled no special habits of the patient until the operation revealed the true nature of her present trouble. Five years ago the patient began to vomit. She vomited nearly everything she ate. She never complained of severe pain, only of vomiting, weakness, and a progressive loss of flesh, which reduced her to her present marasmic condition. She also suffered frequently from headaches, which

causation. If we had only followed our routine custom, to make systematic X-ray examination with the aid of contrast meal in all cases of gastric disease, we would probably have had the satisfaction of completing the diagnosis *ante* and not *post operationem*, and thus have anticipated the revelations of the operation on May 22, 1914.

The operation was performed under ether anesthesia (Dr Landry, assistants, Drs Gessner, Craddock, and Turner).

Median incision about six and a half inches in the epigastric region, extending about one and a half inches to left of umbilicus. The stomach at once presented, very much dilated, with transverse colon attached to its lower border. It became evident immediately that the tumor was intragastric and not attached to the stomach walls. An incision, six inches in length, was made along the anterior surface, in the space midway between the lesser and the greater curvatures, with its center about the middle of the anterior surface of the stomach. The stomach walls, on examination were found to be hypertrophied. The bleeding from the walls of the stomach was controlled by prophylactic clamping. A huge hair ball, slimy, and coated with foul gastric secretion, and of exceedingly hard consistency, was now revealed. The mass was shaped like the stomach, following the contour of the fundus and the greater and lesser curvature and pylorus. It was extracted entire, without great difficulty and, when removed, had the appearance of a large gourd. After wiping off the cavity of the stomach, which contained chyme and considerable thick, tenacious mucus, the gastrotomy incision was closed by four planes of sutures. The first two rows of sutures were hemostatic and included only the mucosa. The seromuscular coat was sutured separately and a final inverting stitch, continuing at right angles, was made with linen, which had been used for all the other sutures.

After finishing the toilet of the peritoneum, the abdominal wound was closed by sutures. The peritoneum with iodized catgut (Bartlett), the muscular planes with the same material, and the skin with through and through silk worm sutures and plain iodized catgut.

The specimen (Fig. 1) weighed two pounds three-fourth ounces, or approximately 967 grams. It was shaped like an inverted gourd and was molded to the contour of the stomach. In the dry state, it measured 18 inches or 46 cm in its longest diameter (along its convexity), 10½ inches or 26 cm in its broadest circumference, 8½ inches or 20 cm around its middle portion, and 6½ inches or 17 cm in its narrowest circumference. The widest part filled the fundus of the stomach, and its narrowest filled the pylorus and duodenum.

It consisted of a mass of matted black hair which, when dry, was felted and gave the appearance of the fur of a wild animal. Mixed with the hair, were particles of earth and vegetable foodstuffs which had gravitated to the center of the mass and

were held in the tangle by mucoid and other organic matter. The mass not only filled the stomach in its entirety, but was gripped tightly by its walls in many places.

An incision of 6½ inches along the anterior surface of the organ was required to permit its extraction. When extracted from the stomach, it was covered with a thick, slimy coat of extreme foulness. The only space for the passage of food was a narrow interspace between the mass and the lesser curvature, where fluids and semisolid foods could be forced from the cardia to the pylorus.

When the patient's sister was told of the nature of the mass, she recalled that the patient had, in earlier childhood, when about six years of age, begun to chew her hair. At first no one suspected this habit, but the fact that her hair never grew long and was apparently always kept cropped, led to an investigation, when it was discovered that she chewed and swallowed her own hair. How long she continued in this practice is not known with exactness, but the girl admits that up to comparatively recent years she indulged in the habit unconsciously and as a mere habit which had grown upon her, without any explanation in her own mind except that she found a childish pleasure in chewing her hair, as well as crumbs of earth and clay, as is often the case with the victims of hookworm disease.

The subsequent history of the patient is uneventful. Apart from a stitch abscess, the wound healed well, and her general condition improved with extraordinary rapidity as convalescence was established and a normal gastric digestion returned. She was discharged from the infirmary on June 19, quite strong and gaining rapidly in flesh. Since her return home she has gained steadily in weight and is now enjoying better health than at any previous time in her life.

SUPPLEMENTARY COMMENTARIES ON BEZOARS

A great deal of curious information pertaining more to the domain of medical archaeology and history, rather than to practical surgery, is associated with the history of bezoars. While not pertinent to a strictly practical paper on the subject of hair balls (which are only a variety of bezoars) the author believes that a supplementary note, written largely from the antiquarian's point of view, may prove of interest to the general reader. Many references of bibliographic and archæologic interest in connection with bezoars may be found in the Catalogue of the Surgeon-General's Library and the *Index Medicus*. An excellent historical summary will be found in the *Dictionnaire Dechambre*, by Dechambre. The latest contribution to this curious subject is pre-

sented by Dr. A. Burchard, under the title "Bezoars in die alte und in die moderne Medizin,"¹ which not only discusses the history of bezoars, but also considers them most interestingly from the point of view of their X-ray relations. I have quoted freely from this valuable and most recent paper in abstract, eliminating the X-ray discussion as applied to human hair balls, as this phase of the subject is fully discussed in the text of this paper.

Bezoars represented an important remedy in the pharmacopœia of Antiquity and of the Middle Ages, even up to the eighteenth century.

Among ancient Hindoos, bezoar stones from goats' stomachs were a well known remedy, which is mentioned in the writings of Susruta in the twelfth century before Christ. It is met with again among the Persians in the manuscript of Muwaffak (968-77) (*Liber fundamentorum pharmacologie*) where the bezoar of goats is also enumerated among 44 drugs derived from the animal kingdom. The Arabs were likewise acquainted with this remedy and "bezoar" is probably derived from the Arabian word Badzehr, so that it is of Arabian origin.

Very curious stories were told of the origin of bezoars. In a book by Adam Lowicer, 1582, they are described as solidified or hardened tears of stags. The stags eat poisonous snakes to protect themselves against intestinal worms and then stand for several days up to their neck in water, so that the snake venom may not harm them. Rosin-like tears flow from their eyes, which harden and are rubbed off by the animals on the trees. For accuracy of this statement, Lowicer refers to the Arabian physician, Albenzoar.

The same story is told by George Nikolaus Schurtz, 1673, in his "Material Kammer" where another explanation is added. "In Peru, the Vicuna sheep eat bezoar herbs in order to protect themselves against poisonous pastures and water. This excellent herb causes the bezoar stone to grow in their stomachs and it therefore has the power to destroy poison."

A catalogue "omnium medicamentorum" published in Braunschweig, Germany, in 1706, still contains "Lacrymæ cervi" which certainly means bezoar; and a price list of H. D. Brückner, in Leipzig, also in the eighteenth century, begins with "ægaropylæ," goat balls, or bezoars, which had been forgotten in the interval.

Much confidence was placed in the effect of bezoar stones, which were considered the best remedy against poison, and as extremely efficient against pestilence. Medical agents, which were credited with similar effects, were therefore frequently named after bezoars, so that there was a tinctura bezoardicus, a pulvis bezoardicus, etc., preparations which really contained no bezoar at all.

"Greswell, in his work on 'Diseases of the Ox,' states that at one time they were supposed to possess the power of enchantment against the viper and the scorpion, against vertigo, epilepsy, dysentery, inflammation of the lungs, malignant fever, the plague, leprosy, and many other maladies. According to this writer, it was put down to the astonishing power of the bezoar that King Edward IV of England, was strengthened and preserved from the effects of an empoisoned wound, and the same magical influence was supposed to be the reason why the Emperor Charles V of Spain, was enabled to free himself from the dreadful thoughts which haunted and disturbed his mind" (N Jacobson).

No wonder, then, that the superstitious and credulous mediæval mind treated these animal concretions with all the reverence and awe of precious amulets and that some of these bezoars were encased in golden caskets encrusted with precious stones.

"Oswald Croll (1609) mentions bezoar as a constituent of pills which were named Laudanum Paracelsi. In view of this high esteem of bezoar, it is not surprising that it commanded a high price. Oriental bezoar was considered more precious than gold. As a natural sequence, adulterations and imitations made their appearance, balls made of all sorts of substances were passed as bezoars. Lowicer (1582) warns against these and mentions three tests to protect against frauds: (1) Pierce the stone with a red hot needle.

¹ Fortschritte auf dem Gebiete der Röntgenstrahlen. XXII. No. 3 p. 321.

If it is genuine, there will be no smoke. (2) Administer poison to an animal or man, and give a powder made from the stone as a remedy. If the individual survives, the stone is genuine. (3) Triturate the stone with saliva, or with water. If it is genuine, it will discolor a cloth."

In more enlightened days, bezoars as well as bezoardic remedies were abandoned as curative agents and are now met with only as historical curiosities. A large series of these rare stones is preserved in the collection of the Pharmacological Institute of the University of Rostock. Following a suggestion of Kobert, Burchard submitted these stones to X-ray examination, in order to obtain information concerning their structure and composition. These investigations yielded some remarkable findings. Ancient medicine was concerned especially with two kinds of bezoar stones, the Oriental and the Occidental. The Oriental bezoar which occurs principally in the fourth stomach and the intestines of the bezoar goat (*capra aegagrus*) living in Syria and Persia, and of the gazelle (antelope *Dorcas*) consists chiefly of cholesterol, bile pigments, and bile salts. It is entirely combustible, diffusing an aromatic odor. The Oriental bezoars examined by Burchard, were, in part, rounded, and in part oval in shape, the exterior was mostly smooth, almost glistening, the diameter between 1 and 5 cm. The radiograph did not invariably show an entirely uniform mass. Most of these bezoars present an internal nucleus which varies with the size of the stone. One bezoar was so compact that the mass did not permit the X-rays to penetrate it, although it was smaller than others, the structure of which was plainly recognizable. Not the slightest suggestion of a structure could be obtained in two spherical preparations of the size of a walnut and of hen's egg, respectively, which were gilded on the outside and were described in the catalogue as Bezoar de Goa, an especially esteemed variety. Perhaps these are not concretions at all, but artificial products, so that the X-ray may permit the distinction of true concretions from artefacts, under certain conditions.

Occidental bezoars come from South America, namely, from the Vicuna sheep

(*Auchenia Vicuna*) and differ from the Oriental by their content in calcium and magnesium phosphate, without cholesterol, bile pigments, and bile salts, so that an incombustible residue is left on incineration. Several specimens were examined by Burchard. Three rough grayish white concretions are designated in the catalogue as Bezoar Porci, presumably from the stomach of the pig¹. The radiographs show a variable appearance.

The term "bezoar" aside from the above described concretions which were formerly employed for curative purposes, is also applied to another kind of concretion. The hair bezoar or trichobezoar, is frequently found in the gastro-intestinal canal of the domestic animals, notably the horse, cow, angora cat, etc., and, less frequently, in the human stomach. Radiographs of trichobezoar (hair balls) show the closely packed masses of hair. The diagnosis of the presence of similar concretions in the stomach or intestines, in the living subject, has always proved very difficult.

Recently the X-rays have come to the front as an important diagnostic adjunct as we have seen in the text of this paper. As regards the utilization of the X-ray method for the discovery of concretions in the gastro intestinal canal of animals, where they frequently exist, not much has apparently been accomplished so far, and March says in his textbook on the clinical diagnosis of the internal diseases of the domestic animals in 1912 that a successful X-ray examination of the abdominal organs is probably possible only in small animals, because the abundant gastro intestinal contents of large animals practically prevent the penetration of the X-rays. Also, in small animals, X-ray examinations have so far been limited to the demonstration of foreign bodies in the abdomen and intestines.

Dr N. S. Mayo, of Chicago, President of the American Veterinary Association, a distinguished authority on this subject, confirms the general impression gathered from veterinary texts that "though hair balls are quite common in cattle, they seldom cause inconvenience and are rarely recognized

¹ Valentini: W. B. De lapide porcino vulgo pedra do porco [in his *Polychresta exot. et c.*] ² Franco: ad Museum 1709 30-44

except on autopsy, or when the animals are slaughtered. In most cases in cattle these hair balls are found in the rumen, or first division of the stomach, although they may be found in the third and fourth divisions. In a majority of cases, these hair balls become crusted with salts, so that they are hard and frequently present a polished surface. Some, however, are furry on the outside. The majority of these hair balls vary from the size of an egg to a man's fist." Dr. Mayo adds, "So far as I can recall, I do not remember that a hair ball has been definitely diagnosed in cattle before the death of the animal. Cattle frequently swallow hard objects such as bone, pieces of metal, old shoes, rags, etc., that give rise to digestive disturbances, but it would be difficult to differentiate between a hard body of this character and a hair ball."

Dr. Hugh A. Trout, of Roanoke, Virginia, suggested in a personal conversation with the writer that hair balls might possibly be dissolved *intra vitam* if they could be recognized early enough by X-rays, by the use of a hair solvent, such as is used in depilatory pastes in which barium sulphide and starch are the chief ingredients. Dr. Mayo, above quoted, whom he consulted on this point, stated that he was very skeptical as to the efficiency of such a solvent. "In order to obtain a fairly efficient action of barium sulphide, it is necessary that it come in rather close contact with the hair and be held there for a few minutes. The condition of hair balls, as commonly observed in cattle, is such that it would be practically impossible to obtain any continued action from barium sulphide, as the rumen of cattle where these balls mostly occur, is very capacious." (Quoted from a letter addressed to Dr. Trout on December 23, 1914, by Dr. Mayo, and kindly transmitted by the former to Dr. Matas.)

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CYSTS OF THE PROSTATE¹

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THE case here detailed resembling the usual condition attending urinary obstruction dependent upon an enlarged benign prostate is of unusual interest because of the operative and post mortem findings, which show the urinary obstruction to be dependent upon a large cyst of the vesicula prostatica, or sinus pocularis, associated with carcinoma of the prostate

Male, 58 years old, referred by Dr A. L. Beaton January 8, 1913. The past history revealed the fact that he had gonorrhea in early manhood, followed by stricture. The stricture was treated for one year and no instrument had then been passed for at least twenty years. During the past year there had been a gradual increase in the frequency of urination and at the present time urination occurred about every hour and a half during the day and night. The stream started with difficulty, was small, and had no projection. There was a slight discomfort over the pubis when the bladder was distended. He had never passed blood, and the urine was noticed to be slightly cloudy. Dr. Beaton was unable to pass a catheter into the bladder.

Physical examination showed the patient to be obese, moderately sclerotic, blood pressure 148 and the heart normal, except for an accentuation of the second aortic sound. Rectal examination revealed a very large prostate, bulging to an unusual degree into the rectum. The surface was smooth and much rounded equal on both sides not tender and with the consistency of a large benign prostate. Massage failed to bring any material from the meatus. The bladder was entered by a coude catheter No. 18 Fr. The residual urine was 20 ounces. The urine examination showed it to be clear, 1,010, no albumin or sugar and no abnormal elements in the microscopical examination. The cystoscopic examination showed the bladder capacity to be 25 ounces. There was considerable resistance to the passage of the cystoscope through the prostatic urethra. The bladder was moderately trabeculated, the ureteral orifices normal, and there was a small amount of posterior intravesical and lateral lobe projection. Palpation with the cystoscope in the urethra and the finger in the rectum revealed the tissue posterior to the urethra to be greatly increased. The phthalein test showed 48 per cent eliminated in one hour.

A catheter was retained in the bladder for three days and the bladder frequently irrigated. At the end of this time the patient had a chill and the temperature rose to 101°. Dr. Horace Binney saw

the patient in my absence and found the prostate as previously noted except that he thought that it was slightly fluctuant and believed that the patient might have a prostatic abscess. The urine at this time was slightly cloudy. The catheter was removed for two days at which time the temperature had subsided. The catheter was then replaced, the residual urine was 18 ounces and slightly cloudy; the microscopic examination showed much pus. The bladder was frequently irrigated through the retained catheter. The temperature continued to range below 100° and the patient's general condition was fairly good.

Operation January 20, 1913. A median perineal incision was made upon a grooved staff. The finger introduced into the wound, revealed the fact that the prostatic urethra was very tight. As the finger was forced into the prostatic urethra it broke into a cavity, and it was believed that it might have entered the rectum. Upon withdrawing the finger there was an escape of from four to six ounces of a thin fluid. Examination, by rectum, showed that the rectum had not been entered. With the finger still in the rectum and another in the cyst sac the cyst surface was found to be slightly elevated, soft, and velvety. The prostatic tissue above the sac was small in amount and very hard. Part of it was removed with scissors, there being no line of cleavage. The finger placed through the vesical sphincter showed no intravesical projections. A perineal tube was placed in the bladder, and another tube in the cyst.

The patient died four days following operation. Post mortem examination produced the illustrated specimen. The abdomen was negative except for carcinomatous nodes in the mesentery and pelvis. A microscopic examination of the prostatic tissues and the nodes proved them to be carcinoma.

In reviewing the pathological literature on the subject of cysts of the prostate it is found that the subject is divided into three classes: (1) cysts dependent upon obstruction of the prostatic ducts with retention of secretion, (2) cystic dilatation of the remnant of Mullers duct which is the homologue of the vesicula prostatica or sinus pocularis; (3) echinococcus cysts. Each condition is very rare, from the post mortem standpoint as well as clinically.

There is little clinical literature referring to any of the forms of prostatic cysts. That which I have been able to find consists mostly of isolated case reports in which the condition

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was not recognized prior to operation or death. The reported cases are best considered under the pathological classification already mentioned, there being only two cases which cannot be so classified. These cases are dermoids involving the prostate if not primary in it; one described by Quervain and another questionable case reported by Prctty. Quervain's case was a man 58 years old, who for 18 years had suffered from dysuria resulting in complete obstruction. The condition was supposed to be dependent upon prostatic obstruction. Operation revealed a dermoid cyst completely filling the pelvis and extending upward to within one finger's breadth of the umbilicus. By a series of operations the tumor was removed and the patient recovered.

1 *Cysts dependent upon obstruction of the prostatic ducts with dilatation of the acini from retained secretions.* This class is the most common, and is believed by Englisch to be congenital in origin. In autopsy on seventy newborn male children he found five instances of cyst formation near the sinus pularis.

The fact that the majority of the recorded cases were under fifty years of age and the histological study of some of the post mortem material, especially the study of Englisch, forms the basis for the belief that the origin of these cysts is congenital. Yet the histological studies of Desnos are at variance with those of Englisch which has led to the belief by Legueu and Verhac that the embryological inclusions may be of a different order. The cysts seldom attain much size. They are usually single, small and unilocular, yet they have less often been observed to be multiple and multilocular. Le Denteu believes that the cysts are formed by the coalescence of several dilated acini, the partitions being wholly or partially destroyed by pressure atrophy. They have been most commonly observed projecting into the prostatic urethra and covered by the urethral mucous membrane, and less commonly projecting into the bladder near the bladder sphincter. The cyst content is a viscid, clear, opaque, or yellowish brown albuminous fluid containing epithelial cells, leucocytes

and detritus, but no organisms have been demonstrated in the cyst content of any of the recorded cases. The histological study of the cyst walls have shown them to be lined with squamous epithelium in most instances but in a few, cylindrical epithelium has been found.

Following is a summary of the recorded cases of this type.

Englisch. Man 40 years old. Cyst discovered post mortem, single, and protruding into the bladder like a middle lobe of the prostate, beneath the mucous membrane of the bladder. In size, 1.3 by 1.5 cm. The thickness of the cyst wall was 1 mm. The content was an albuminous fluid with epithelial cells and detritus. The histology showed the cyst walls to be composed of round and cylindrical cell epithelium.

Dolbeau. Post-mortem specimen. Cyst found on either side of the verum montanum. Cysts the size of pers projecting into the prostatic urethra and covered by the urethral mucous membrane.

Le Denteu. Post mortem specimen obtained from a man who had haematuria. The bladder was trabeculated and contained several stones. Posterior to the urethra was a cyst the size of an apple extending from the lower part of the prostatic urethra to the vesical sphincter. The ducts of the prostate were much dilated. The cyst was unilocular and was believed to be due to the coalescence of many dilated acini.

Home. Man, 60 years of age in whom no catheter could be introduced into the bladder. The post-mortem specimen showed a cyst of the prostate the size of an apple with numerous dilated prostatic ducts the size of goose quills.

Desnos. Post mortem specimen obtained from a man 70 years old which showed a dilated bladder and a prostate the size of an apple. There was a cyst the size of an egg, posterior to the urethra, but not connected with the sinus pularis or ejaculatory ducts. Pressure on the prostate brought forth a somewhat sticky reddish brown fluid from the prostatic ducts and the glandular elements of the prostate were everywhere dilated. The histology of the cyst wall showed it to be made up of connective tissue with large numbers of spindle cells and the inner surface lined with a cubical epithelium. Desnos believes that the cyst was due to a coalescence of numerous small retention cysts.

Socin. Post mortem specimen obtained from a man 50 years old. A cyst the size of a bean and covered by urethral mucous membrane was situated at the posterior right side of the prostatic urethra. The content was clear and serous in character.

Burkhart. Man 51 years old who for six months had dysuria with partial retention. Cystoscopy showed a cyst the size of a walnut round in shape, and close to the orifice of the bladder. It was red.

dish gray and translucent. The cyst was destroyed by a suprapubic operation.

Kornfeld. Man 30 years old with acute retention. Rectal examination revealed a large tumor of the prostate, not tender. On pressure the left lobe disappeared with the appearance of blood tinged fluid from the meatus. The symptoms disappeared.

Butrulle. Man 69 years old with symptoms of retention of urine, and a very large prostate by rectum which was fluctuant, and believed to be a prostatic abscess. The patient developed pneumonia and died. Post-mortem specimen showed a large tumor of the prostate consisting of a multilocular cyst involving all lobes of the prostate.

Legueu and Verliac. Man 40 years old with retention of urine. The condition was believed to be prostatic obstruction because of the retention and resistance to the passage of instruments through the prostatic urethra. Operation did not reveal an obstructive gland. After death the post-mortem specimen showed a cyst in the right lobe of the prostate and a smaller one directly behind it. The larger cyst was the size of a grape and the smaller the size of a pea. The remainder of the prostate was normal. The histology of the cyst showed it to be lined with pavement epithelium.

Falta. A case of multiple retention cysts which were the size of poppy seeds found at autopsy in a man 77 years old who died of "cancerous cachexia."

Burger and Oppenheimer. Man, 38, died of peritonitis. A cyst, the size of a large pea, was located in the left lobe of the prostate, just below the internal sphincter and projecting into the urethra. Surrounding it were a few tiny pin head sized cysts. The cysts were directly beneath the urethral mucous membrane. The content was a thick mucoid, greenish yellow fluid which contained a few degenerated epithelial cells and granular detritus.

Abbe. Man, 35 years old, with retention of urine for one year. Examination showed no enlargement of the prostate and a residual urine of one pint. A suprapubic cystotomy revealed a cyst the size of a cherry located at the anterior margin of the internal meatus and projecting into the bladder. The cyst was removed, the patient recovered, and the symptoms were relieved.

Arthur Cabot records two cases. One a man 87 years of age who was leading a catheter life for complete obstruction prostatic in origin. The prostate was much enlarged fluctuant, and resembled a prostatic abscess. The tumor was punctured by a trocar through the rectum and two ounces of a viscid fluid was obtained. The patient died 17 days later of pyelonephritis. The post-mortem specimen showed early carcinoma of the prostate and besides the emptied cyst cavity there was another smaller cyst, containing a thick, opaque, yellowish-white fluid with epithelium, leucocytes and debris, but no organisms.

The second case was a man 46 years old with symptoms of retention. Cystoscopy revealed a cyst the size of a cherry located to the left of the

bladder outlet and projecting into the bladder. The cyst was destroyed by a suprapubic operation.

Mikhailow, in recording a case of a cyst of the sinus pocularis mentions six cases of cysts of the prostatic ducts which he had observed but I have been unable to find any record of them.

2. *The second class, that of dilatation of the vesicula prostatica*, is generally considered to be congenital in origin and dependent upon a defect in the process of obliteration of Muller's duct.

The utricle, being a remnant of Muller's duct, has no genetic relation to the prostate gland or the seminal vesicles. Congenital defects in the obliteration of this structure, may result in cysts, which in themselves obstruct the outflow of urine or by the disturbances of adjacent structures may interfere with micriturition or the ejaculation of semen.

Springer found two cysts of the sinus pocularis in autopsies performed on sixty-two male children who died soon after birth. Cysts of this type are unilocular and may obtain a considerable size, the one already described and illustrated here being the size of a large lemon.

When the cysts are small they are found in the prostatic urethra, as observed by Mikhailow, when large, the swelling not only obstructs the urethra but projects backward into the rectum as a rounded tumor resembling bilateral lobe enlargement of the gland.

The lesser distended sinus pocularis which is occasionally observed by rectal palpation in those cases presenting a condition similar to chronic prostatitis, and from which the retained secretion may be expressed by rectal pressure leaving a depression at this point, may, in the writer's opinion be considered as acquired rather than congenital and dependent upon inflammatory changes, because of the microscopical character of the expressed secretion. The cystic condition of the gland, of the variety just mentioned, is now, not infrequently observed by the use of the posterior urethroscope and may or may not be a stage in the development of the larger sinus pocularis cysts. Yet the information obtained by the examination of the cyst content, which is possible by massage, should determine the point.

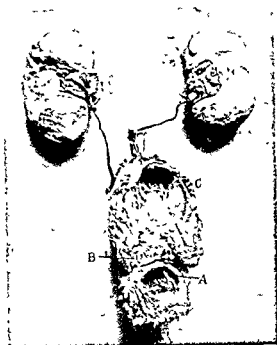


Fig 1 Anterior view of specimen 1, Cyst B carcinomatous prostatic tissue, C, bladder

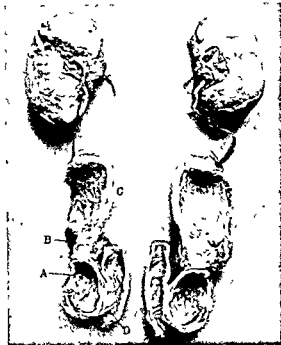


Fig 2 Lateral view of specimens 1, Cyst, B carcinomatous prostatic tissue, C, bladder D, rectum

conducted with an instrument in the urethra and a finger in the rectum in cases with prostatic obstruction and retention, evidently non-cancerous, and yet, obstructive to the passage of instruments through the prostate, would seem to be the only diagnostic feature to suggest a cyst of the prostate of this variety. This same diagnostic observation applies to echinococcus cyst, yet these cysts are more likely to be seen projecting into the bladder with the cystoscope and fluctuation is more likely to be detected in the enlarged gland. Moreover, in echinococcus cysts the abdominal tumor is often large and associated abdominal swellings in connection with the urinary signs and findings should render a diagnosis in this class more often than in the preceding classes.

In regard to *treatment* no definite operative procedures exist. In the class of retention cysts, Cabot, Abbe, and Burkhart, after observing the cyst projecting into the bladder, destroyed the cyst by a suprapubic operation, but retention cysts confined to the prostatic urethra have not been recognized clinically

If they can be demonstrated by means of the deep urethroscope, their destruction should be easily accomplished with the new instruments devised for operative interference in this region.

Mikhailow, who discovered a small cyst of the sinus pularis, destroyed it through a deep endoscope with entire relief of symptoms. When small cysts of this variety are discovered this procedure should be easy of accomplishment, but when the cyst is of the size of the one recorded by the writer such a procedure could hardly be expected to accomplish a cure, and an attempt to remove the sac, with or without the prostate, should be undertaken either by the perineal or suprapubic route, but preferably by a dissecting perineal operation.

When an echinococcus cyst is present it is best dealt with by extirpation or incision and drainage, either through the abdomen, perineum, or rectum. The former method has been followed by satisfactory results by Tuffier and by Winterberg, the former accomplishing the extirpation by the abdominal

route and the latter through the perineum Lavigne incised and drained such cysts through an abdominal approach in two cases Routier practiced the same procedure in a single case Bryant incised and drained a case by the perineal route; and incision and drainage was also carried out by Dolbeau and by Duplay in one case each. Spence and Maunder each drained a cyst by rectal puncture, and Tillaux by a rectal incision Nicaise punctured the cysts in one case by means of a catheter passed into the urethra.

The method of treatment to be employed must necessarily depend upon the type of cyst present and the special features of the cyst in the given case

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THE SURGICAL TREATMENT OF THE TUBERCULAR URETER IN THE FEMALE¹

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WHEN performing nephrectomy for tuberculosis of the kidney, consideration of the disposition of the tuberculous ureter is of almost equal importance with that of the kidney itself. Should the ureter be left, removed in part, or in its entirety? When left, how shall it be treated? When removed, by what route or combination of routes can this be best accomplished?

It is the object of this paper to advocate (1) the removal of the ureter with the kidney whenever tuberculous changes in the ureter exist, (2) the adoption of the combined transperitoneal and retroperitoneal routes when the ureter and the kidney are removed at the same time, (3) the use of this same combination of routes when as a secondary procedure the ureter with its accompanying sinus is removed.

The term "complete" as generally applied to ureterectomy refers to the removal of the lumbar and pelvic portions of the ureter alone. When so used it is confusing for the vesicovaginal portion is not considered yet it constitutes an essential part of the tract and its condition may necessitate primary or secondary removal. When the term ureterectomy is used it will be in reference to the complete removal of the lumbar and pelvic portions though recognizing that this usage is strictly speaking incorrect as only part and not the entire tract is referred to.

It is to the student of end results that we must look for the solution of the problem of primary versus secondary ureterectomy for tuberculosis of the ureter. The removal of the tubercular kidney alone or with part of its ureter may and in a certain percentage of cases does relieve some if not all of the symptoms characteristic of the lesion yet the best authorities recognize that this relief is by no means certain and that the possibility of distressing and dangerous sequela exists. Roy

sing states. "Formerly when I removed as much of the ureter as possible and lowered the stump, the latter often became the starting point for an exceedingly dangerous diffused tuberculosis in the retroperitoneal tissue and in the abdomen." Kapshammer is of the opinion that "very little attention has been paid to the disposition of the tubercular ureter in nephrectomy, as a rule the ureter is cut away from the pelvis of the kidney and tied off, many times resulting in post operative complications." Boyce says "In fact, in a respectable number of successful nephrectomies for tuberculosis of the kidney, subsequent ureterectomy for tuberculosis of the kidney has had to be done." Henry Morris is of the opinion that "nephrectomy alone is very frequently insufficient to effect a complete cure, etc., etc." Tilden Brown Kelly, Meyer and many others could be quoted to support the view that though the activity of the lesion in the ureteral tract may be checked or even destroyed by the removal of the kidney alone, or with a part of its ureter yet whenever there remains any portion which is the habitat of tubercular bacilli there is of necessity danger lurking and that the advisability of primary removal of this tissue should receive serious consideration.

In studying the question of primary ureterectomy it is of interest to consider (1) the usual manner of invasion and (2) the degrees of involvement of the ureter with renal tuberculosis. For some time there existed a diversity of opinion as to the manner or process of ureteral invasion whether by ascent or descent of the urine stream. Today the weight of opinion is in favor of descent or in the direction of flow that in the downward course of the urine the tubercular bacilli implant themselves on the mucous membrane of the ureter and invade the structure.

Exact information as to the extent of ureteral invasion can be obtained only in those

¹ Read before the American Urological Association, White Sulphur Springs, West Virginia, May 15-16, 1911.

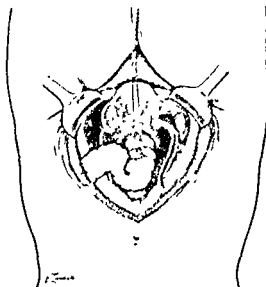


Fig. 1. To secure a field of exact surgical manipulation a temporary suture is passed through the post uterine wall near the juncture of the corpus with the cervix. Where traction is made upon this the entire cervical region is brought within easy reach of the operator and the corpus is forced out of the field of vision. A second suture is passed through the ovary of the side affected, then through the outer portion of the round ligament where this suture is tied the adnexa are also removed from the field of vision. The incision of the pelvic peritoneum is to the outer side of the ureter and through it the ureter with its fascial sheath is disclosed.



Fig. 2. Case 1. Showing the greatly thickened cellular sheath of the ureter in situ.

cases where complete observations have been made either by operation or by autopsy. Steinthal, in 1885, recorded that "in genito-urinary tuberculosis he found the kidney involved in every case in nine cases the kidney alone and the lower tract in 50 per cent." Fischer, in 1892, records that "in 62 cases of tuberculous disease of the kidney both kidneys, the ureter and the bladder were affected in 17 and one kidney together with the ureter and bladder were affected in 28." In every instance the ureter was affected but no statement was made as to the extent of involvement. Kelly, in 1914 found that of the 31 specimens in which he has the ureters as well as the kidneys all show tuberculosis of the lower end, and of these 15 had tubercles distributed through the course of the ureter while in 8 there were only a few scattered tubercles.

It is not always possible to determine the extent of ureteral involvement prior to operation. Subjective symptoms are of little value. Painful micturition, for example may be just as severe with renal tuberculosis alone as when ureter and kidney both are diseased. Objective symptoms may be of great assistance. If the ureter is considerably involved cystoscopic examination and ureteral catheterization or exploration furnish much information. The 'golf hole' appearance of the ureteral mouth is positive evidence of a well advanced tuberculous involvement of the ureter, the depression being the result of a much thickened and shortened ureter. The amount of obstruction to the catheter as it is passed up into the ureter is evidence of occlusion by debris or ureteral thickening and determines to some extent the degree of tubercular invasion. Ureteral catheterization it must also be remembered may be misleading as when there exists certain congenital ureteral abnormalities, as for instance a Y shaped ureteral tract. Here the X ray after an injection of some silver salt through the common ureter may locate the point of bifurcation. The median transperitoneal approach

becomes a valuable diagnostic means, as under these circumstances the thickened ureteral tract is easily distinguished intra-abdominally, and catheterization per abdomen can even be done to determine the source of disease if considered necessary.

When the vesicovaginal portion of the ureter is affected, digital examination per vaginam reveals a thickened cord extending along the anterior wall from the base of the broad ligament to the neck of the bladder.

In determining the source of tubercular involvement, whether in the right or the left kidney, too much importance should not be given to a single symptom, for example, pain, a symptom upon which the patient with renal tuberculosis usually lays great stress, may be located in the opposite region to that affected.

On digital examination thickening of the vesicovaginal portion of both ureters may be discovered yet the examination of the urine from one side only may show pathologic changes. This is usually so when the bladder mucous membrane has undergone thickening as the result of a prolonged irritation from the secretion of the diseased kidney. This point is well illustrated in Case 6.

It is of interest to observe that in only one of the six cases here reported was tubercle bacilli discovered in the urine, and in this case not until twenty separate tests were made



Fig 4 Case 2 Showing the ureter stripped of its cellular sheath a part of which is seen attached to its distal end

(Case 7) It may be further stated in explanation that on several occasions the same specimens were submitted to different pathologists

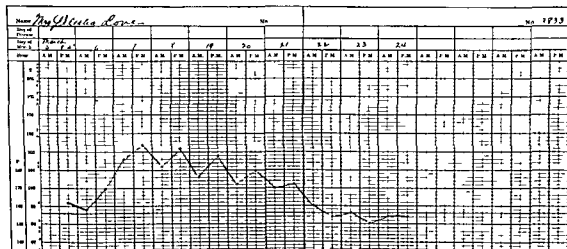


Fig 3 Temperature chart Case 2

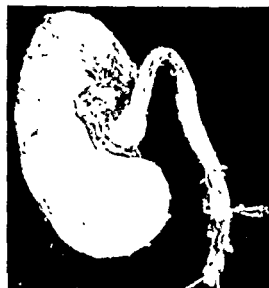


Fig. 6. Case 1. This photo also shows the ureter stripped from its cellular sheath, part of which is seen attached to its distal end.

While therefore, the finding of tubercle bacilli in the urine associated with certain characteristic symptoms is corroborative evidence, their absence does not make the diagnosis negative. Symptoms commonly associated with renal tuberculosis and the presence of pus are as a rule sufficient for a diagnosis.

The mucosa is of course the first structure invaded by the bacilli, and in the majority of cases it is alone involved. The muscular coat is not so commonly invaded. Though the fascial sheath may at times be involved in the tubercular process, the thickening of the sheath must not be interpreted as positive evidence of tubercular invasion, for the law common to all connective tissue when in close proximity to an inflammatory process is applicable here as elsewhere. The extent of the invasion in the different layers which constitute the wall of the ureter can, however, be determined only by microscopical examination.

Our present knowledge of the subject therefore leads us to the conclusion that when the kidney is tubercular the ureter in the majority of cases is in part of its course, and usually in greater part, likewise involved, and that the most common site of involvement is the lower rather than the upper part. Also that when the kidney alone is removed the success of the operation is often jeopardized (Cases 6 and 7).

It is to be admitted that if the vesicovaginal portion of the ureter be left, it becomes a possible source of progressive pathological disturbance but in view of what has been pretty well established, namely, that the lumbar and pelvic portions of the ureter are the

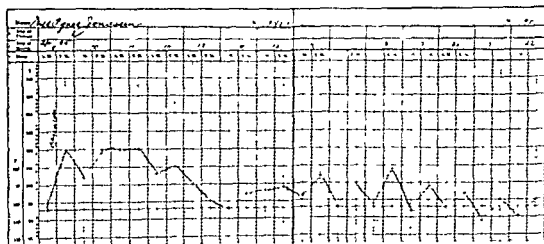


Fig. 5. Temperature chart, Case 1.

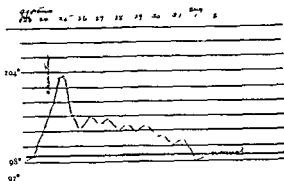


Fig 7 Temperature chart, case 4

sources of greatest possible danger, they should receive primary surgical consideration. The advisability of removing the vesicovaginal portion of the ureter simultaneously with the removal of the kidney and the rest of the ureter is however debatable.

The routes which have been adopted for the removal of the kidney and its ureter are (1) retroperitoneal, (2) transperitoneal, (3) retroperitoneal and transperitoneal, (4) retroperitoneal and vaginal, (5) retroperitoneal, transperitoneal, and vaginal. The retroperitoneal route is the one commonly adopted, but by it the ureter is frequently removed only in part and its remainder variously disposed of as follows: (1) the removal of a small portion of the ureter with the kidney, ligation, sterilization of its cut end and leaving of the remaining portion *in situ*, (2) the removal of a small portion with the kidney, the injections of several minims of a 95 per cent carbolic acid solution into the remaining ureteral canal, ligation, and leaving of the ureter *in situ*, (3) the removal of a small portion of the ureter with the kidney and stitching of the remaining cut end in the lower angle of the wound, (4) the removal of as much of the ureter as can be reached through the original incision or a combination of incisions, ligation, and sterilization of the cut end.

The technique of the combined transperitoneal and retroperitoneal routes herein advocated is as follows. The abdominal cavity is entered through a median incision 7 cm. or more in length, between the umbilicus and the symphysis. The patient is put in the Trendelenburg posture and the intestines forced

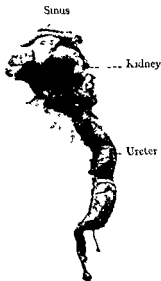


Fig 8, Case 4. This photo shows the lumbar sinus, the shell of kidney previously operated on and ureter in continuity.

into the upper abdomen and kept there, thoroughly protected by moist gauze pads. The pelvic organs are now examined and any lesion or abnormality discovered, corrected. To facilitate the exposure of the field and the manipulation of the ureter, a temporary catgut suture is passed through the posterior uterine wall near the juncture of the corpus and cervix. When traction is made upon this suture, the fundus is lifted up to the pubic arch and the cervix is removed from the field of vision. Another preliminary step with much the same object in view is to pass a temporary suture through the ovary of the side affected, then through the abdominal wall or outer portion of the round ligament. When this suture is tied the ovary and tube are also lifted out of the field of vision. If the ureter of the right side is diseased, its entire pelvic portion can be plainly seen passing over the pelvic brim and coursing downward to the base of the broad ligament, near the cervix. The peritoneum and the underlying fascial structure is now grasped with forceps immediately to the outer side of the ureter as it passes over the brim of the pelvis and an incision made into the loose cellular structure, this incision is continued downward to within 1 cm. more or less of the cervix, and

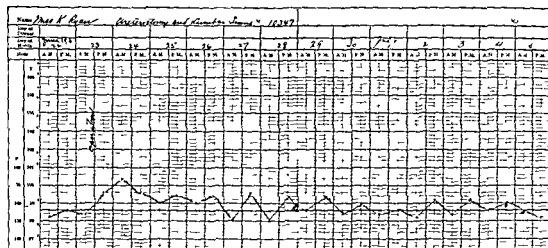


Fig. 9. Temperature chart. Case 3. Considering the extent of surgical work done in these combined transperitoneal and retroperitoneal operations the temperature charts show a favorable comparison with the average transperitoneal operation alone.

upward, if desired to the base of the cecum. Beginning at the brim of the pelvis a blunt dissection or enucleation of the ureter from its surrounding tissues is made with the finger. To facilitate this a heavy suture material or a narrow strip of gauze is passed under the freed portion of the organ immediately above the promontory. Gentle traction on this furnishes sufficient resistance to facilitate greatly the separation of the ureter down to and beyond the uterine artery. The uterine artery is as a rule distinctly seen, it is usually not necessary to disturb it more than to separate its cellular connection with the ureter and to tie a small arterial branch which enters here the fascial sheath of the ureter. A chromic catgut suture, No. 1, is now passed around the ureter and tied below the uterine artery, which step can be done by this technique with exactness and comparative ease. The ureter is now grasped with a curved artery forceps at a point 1 cm. above the tie, before severing the ureter between the forceps and the tie, a piece of gauze is placed in the cellular bed immediately below to prevent a possible contamination of this field. On severing the ureter both cut ends are treated with carbolic acid and alcohol and the gauze removed. The proximal cut end being now pulled up out of the wound is tied very tight and again

after the forceps is released so as to prevent any possible escape of ureteral contents when the kidney and ureter are manipulated in their removal through the lumbar incision. On freeing the forceps the crushed portion of the canal is opened and sterilized with carbolic acid and alcohol. Gentle traction is now made on this freed pelvic portion of the ureter while blunt dissection with the finger is continued upward along the ureteral tract to the immediate region of the kidney. In the retroperitoneal space thus created above the pelvic brim the freed ureter is placed, folded on itself, and the rent in the peritoneal and fascial structure closed with a continuous plain catgut suture. When the left ureter is the seat of disease the technique is practically the same excepting that the dissection is made under the sigmoid, preferably from above down. When the enucleation is completed and the ureter severed, this freed portion is pulled up from under the sigmoid. In this way the lumbar portion of the ureter is more easily reached and can be freed as high up as desired.

The abdominal incision is now closed and the patient turned upon her stomach and a lumbar incision made from a point immediately above the last digitation of the serratus posticus inferior down to a point immediately

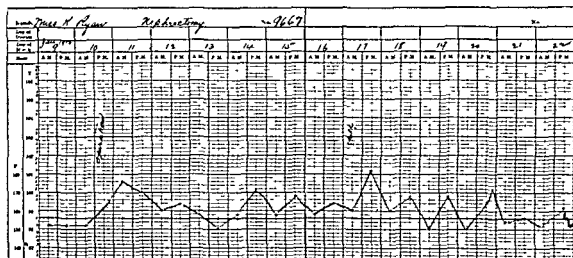


Fig 10. Temperature chart, Case 7.

above Petit's triangle. This incision is practically parallel with the insertion of the latissimus dorsi along the lumbar fascia. The latissimus dorsi is exposed and severed along its line of insertion and drawn to the outer side of the wound, thus exposing the underlying lumbar fascia. An incision is next made through the lumbar fascia in the upper angle of the wound, parallel to and immediately below the under border of the last rib. As the last dorsal nerve is usually less than 1.5 cm. from the rib, the importance of keeping close to the lower border of the rib is apparent. As this incision brings us to the outer side of the nerve, and as the nerve in its course downward tends in the general direction of the symphysis pubis, an extension of the incision downward through the transversalis and internal oblique muscles can be continued with but little fear of injury to the nerve. The incision can be extended upward without injury to the nerve by following closely the lower margin of the rib.

The incision through the lumbar fascia immediately below the rib exposes the transversalis or intra abdominal fascia about where it splits to form the fascial capsule of the kidney. The line of demarcation between the dark yellow or subperitoneal fat and the light canary colored or intracapsular fat is distinctly seen. As the kidney is approached

through an incision made in the posterior layer of the fascial capsule the danger of entering the peritoneal cavity is avoided.

The average tuberculous kidney, though larger than normal, can usually be delivered, upper pole first, through a fascial and muscular incision 7 cm. in length; but when the kidney has increased very much in size or the inflammatory process has been sufficiently extensive to affect the perirenal tissues with resulting fixation of the kidney, the incision should be lengthened and the kidney delivered by the pole most convenient. After delivery the fatty tissue is carefully separated from the fibrous capsule of the kidney, not only from the anterior and posterior surfaces but also from about both poles down to the hilus.

At this stage of the technique of nephrectomy it is usual to apply one or two powerful clamps to the kidney pedicle, sever and tie. The objections to such a procedure are that if the ureter is thick, the forceps fail to grasp the vessels and they slip through the blades to the great discomfort of the operator and often danger to the patient, also crushing or severing the ureter in nephro-ureterectomy is undesirable and unnecessary.

Where it is possible, and in most cases it is, I prefer the following technique in removing the kidney. The ureter and the renal vessels are surrounded by a fascial covering which is

a continuation of the fascial capsule of the kidney, this covering with the fat commonly found about the pedicle is stripped away from ureter and vessels. The ureter and vessels are thus clearly defined and the finger is passed between to separate them, so that there may be no possible chance of ligating them together. The ligation of the vessels is preferably made with a double ligature, No. 2 plain catgut, passed between them and tied twice on each side. The kidney is now cut away from its vessels close to the concave margin. No forceps are here necessary as the contents of the renal pelvis cannot escape through the blood-vessels. We now have the ureter alone to consider. If the fascial covering of the ureter is very thick it is significant of tuberculous change in it and should be entirely removed with the ureter. If it is not very thick the ureter may be easily peeled out and as much of the capsule cut away as thought necessary. When the former method is followed the finger is forced into the bottom of the wound to locate the coiled up free end of the ureter, the tissues between it and the finger are severed and the ureter pulled through. Freeing of the remaining attached portion is now easily accomplished and both organs are removed intact. When the latter method is followed the line of cleavage between the fascial covering and the ureter proper is easily followed and the stripping can be continued down to the ligated cut end of the ureter. At this stage the ureter and sheath resemble the inverted finger of a glove as the finger of the hand emerges from it, and as much of this fascial covering is cut away with the ureter as thought necessary and the kidney with its ureter removed.

As there is no contamination of the wound and no hemorrhage, drainage is not necessary. The lumbar incision is closed, layer by layer with plain catgut No. 1, care being used while suturing to avoid injury to the last dorsal nerve.

The advantages of the median transperitoneal route for dislodging, freeing, and releasing the pelvic portion of the ureter are applicable to both the male and the female. These advantages are, however, greater in the female than in the male, which fact is readily

appreciated when we compare the anatomical relationship of the pelvic organs in the sexes. In the male the ureter passes down along the pelvic wall, without encountering an important structure not common to both sexes until it reaches the bladder region. In the female the ureter passes along the base of the broad ligament and under the uterine artery before it reaches the bladder, making the uterine adnexa play an important part in the problem of surgical approach to the ureter. Because of this relationship the complete removal of the pelvic portion of the ureter in the female by any of the retroperitoneal methods is difficult and may prove dangerous. Moreover, when the ureter is removed through an extended lumbar incision, an incision to the outer side and parallel to the rectus or through a combination of incisions as advocated by Kelly, there is an extensive surgical invasion of tissue, tissue filled with important nerves and blood vessels, which when injured often result in great discomfort and even permanent distress to the patient. When the combined route as described and advocated in this paper is adopted there is resulting a minimum destruction of tissue and the least possible risk of injury to nerves and blood vessels.

The sharp angle which the ureter follows as it curves over the brim of the pelvis, the depth of the pelvic cavity and the unyielding bony walls which it closely follows are responsible for much of the difficulty encountered in enucleating retroperitoneally the complete pelvic portion of the ureter. The median transperitoneal route, on the other hand, permits of direct approach and unrestricted access, and when pelvic complications exist, recognized or unrecognized, previous to operation they can be immediately corrected to advantage. When unrecognized inflammatory pelvic lesions in the vicinity of the ureter exist, particularly when pus collections are formed and the subperitoneal tissues are involved, the risk to life by enucleating the ureter retroperitoneally is much increased, as under these circumstances there exists the possibility of rupture of the pus sac, tearing into and infecting the peritoneal cavity.

Therefore retroperitoneal surgery of the pelvic portion of the ureter in the female

should be condemned as it is at best blind surgery and does not afford the safeguards at our command.

As many tuberculous kidneys are found prolapsed, an abnormality which may enter as a possible factor in the causation of the tuberculous invasion, the question of position is to be considered. If the kidney is found resting in the false pelvis and not fixed by inflammatory exudate, it should be removed with the ureter through the median transperitoneal incision as its pedicle is easily accessible and the risk of infecting the peritoneum from the kidney contents is practically nil.

If by digital examination *per vaginam* or cystoscopic examination and catheterization there is discovered evidence of tubercular invasion of the ureter, nephro ureterectomy should be the operation of choice. If previous to operation no evidence of ureteral involvement has been discovered, nephrectomy alone should be the operation selected, but if, when the kidney is removed, there is discovered evidence of tubercular invasion in the upper portion of the ureter, the removal of the entire ureteral tract is justifiable, as it is reasonable to suppose that the remaining portion is involved.

If the immediate removal of the ureter is considered desirable, as much of the ureter should be removed with the kidney through the lumbar incision as can be conveniently reached, and then the patient turned upon her back and the pelvic portion removed through the median transperitoneal incision.

If the ureter is left, secondary ureterectomy will depend upon such sequelæ following operation as persistent intra abdominal pain or distress, invalidism or incapacity for work as the result of a persistent lumbar sinus or painful and frequent micturition. Secondary ureterectomy with or without its accompanying sinus is done almost universally retroperitoneally, but practically the same objections are applicable to its removal by this route as are applicable to the removal posteriorly of the tuberculous ureter and kidney. The transperitoneal combined when necessary with the retroperitoneal route are the routes of choice.

It is to be admitted that many of the arguments hold good respecting the desirability of immediate elimination of the vesicovaginal portion of the ureter when nephrectomy is performed for tuberculosis, which hold good respecting the desirability of removing the lumbar and pelvic portions. There are, however, objections to the immediate removal of the former which do not exist, or exist to a lesser degree, to the removal of the latter, i. e., that its removal makes the operation considerably more complicated and introduces an element of possible peritoneal infection through the vaginal canal. Again, if the vesicovaginal portion is not removed its subsequent history can be easily followed, and when found to be a continued source of disturbance can be removed *per vaginam* at a selected time. The dangers of its removal primarily or secondarily are a resulting vesicovaginal fistula and injury to the uterine artery. Both accidents can be avoided, however, by first carefully separating the anterior vaginal wall from the bladder wall, and when the bladder wall is not itself diseased, which would demand its removal with the ureter, the sheath of the ureter can be cut open lengthwise and the ureter proper peeled out. When the operation is immediately done following the removal of the kidney and remaining portion of the ureter, the catgut which encircles the ureteral cut end under the uterine artery may be passed through the vaginal vault into the vagina and will aid materially in directing the work and in preventing accident to the uterine artery.

It is difficult to draw correct conclusions from statistics regarding the relative dangers of comparative operations as no two cases are alike and operators vary in skill. Statistics may be serviceable however, in generalizing. The mortality in nephrectomy is between 2 and 3 per cent. If nephro ureterectomy can show a mortality no greater its objection or disadvantage from this standpoint is not to be considered. Of the five cases reported in this article operated on through the combined route, three were nephro ureterectomies, one ureterectomy with a degenerated kidney and lumbar sinus, and one ureterectomy with a simple lumbar

sinus. The mortality from operative work was nil. One case died six weeks after from hæmorrhage of the lungs, having had a pulmonary tubercular involvement complicating her case.

Morbidity as the result of nephrectomy for tuberculosis of the kidney is more or less frequent, but from nephro-ureterectomy as herein described it has been nil. Symptomatic results were ideal in every case.

The argument used in opposition to the combined transperitoneal and retroperitoneal routes, that the resulting shock is severe and the consequent risk is out of proportion to the advantage offered, is not a valid objection, as is shown when reviewing the post-operative histories of the following cases.

CASES IN WHICH THE URETER AND KIDNEY WERE REMOVED AT THE SAME TIME

CASE 1. M. F., aged forty-nine

Chief complaint Frequent and painful micturition

Family history negative with respect to tuberculosis

Menstrual history normal until one year ago. Has not menstruated for four months. Married twenty six years, six children, two dead, one of tuberculosis, one at the age of five months of spinal meningitis. Illnesses pleurisy seventeen years ago. Operated upon for fistula *in ano* when twenty-five years of age.

Present symptoms began June, 1912. Burning micturition, increasing in frequency and distress. Small quantities every twenty minutes. More frequent at night. No blood seen in urine.

Maximum weight 163 pounds. Minimum weight 150 pounds.

Physical examination. General appearance good, well developed, and nourished, somewhat anæmic. Thorax. Heart accentuated second over apex and pulmonary with slight systolic blowing over apex. Lungs. Respirations limited in lower left and breath sounds diminished over whole left lung. Abdomen. Right kidney low, enlarged somewhat tender, left kidney movable, two thirds palpable, liver two fingers below costal margin, spleen palpable. Genital organs. Uterus retrodisplaced, adnexæ normal.

Cystoscopic examination (by Dr. Osgood). Capacity of bladder $3\frac{1}{2}$ ounces. Cystoscope shows marked thickening, redness, swelling, roughness, and ulceration of right side of floor and posterior wall. Right ureter mouth is a rounded cavity, deep red, situated posterior and external to its normal location, i.e., ureter is retracted. Ureter mouth is ulcerated and bleeds on slightest touch. Cannot be catheterized. Thick, turbid fluid is

ejected from it. From appearances a right renal tuberculosis is suspected. Left side and left ureter normal. Left ureter easily catheterized, urine normal in flow and appearance, only slight trace of albumin.

Microscopic examination of bladder contents shows occasional clumps of pus-cells. Culture negative.

Operation, November 25, 1912. Abdominal findings. Uterus retroverted, freely movable. Appendages normal. Appendix and gall-bladder normal (?). Right ureter enlarged along whole length to size of index finger. Right kidney prolapsed, enlarged. Left kidney movable. Left ureter normal.

Ureterectomy. Laparotomy, median abdominal incision. Ureter dissected out to base of bladder where it was ligated and stump cauterized. Proximal free end of ureter pushed up under cæcum and ileum. Peritoneal incision closed.

Nephrectomy. Lumbar incision. Enlarged kidney, short pedicle. Renal vessels tied off with plain catgut. Kidney and ureter removed intact.

Pathological report. **Microscopic examination.** Kidney 12×6 cm. Capsule thickened, adherent. On section, several cubic centimeters of thin pus escapes from pelvis. Calices enlarged. Mucosa granular, shows many pale tubercles. Papillæ absent from many calices. Kidney parenchyma pale. Cortex not reduced, many tubercles about 1 mm in diameter are scattered through kidney substance especially at cortex.

Ureter 2 cm thick, 20 cm long.

Microscopic examination. Albuminoid degeneration throughout entire parenchyma. Few foci of lymphoid cells under capsule. No other changes in cortex. In pelvis is a large area of caseation and a few small tubercles with giant cells. Ureter diffusely thickened, converted into epithelioid tissue with tubercles.

Anatomical diagnosis. Tuberculous pyelitis. Diffuse tuberculosis of ureter.

Laboratory. Urine before operation. Yellow, heavy white precipitate, cloudy, acid, heavy trace of albumin, no sugar. Pus culture negative. No tubercles found. After operation. Amber, smoky, white precipitate acid, 1,022. Very heavy trace of albumin. Hyaline and granular casts, pus. One month post-operative. Faint trace of albumin, a few pus cells. Sputum one week after operation shows tubercle bacilli.

Course after operation. Good immediate recovery, urinary symptoms were immediately relieved. Wounds healed primarily. Bloody sputum showing tubercle bacilli increased, and she died of a pulmonary hæmorrhage six weeks after operation.

CASE 2. C. L., age thirty-five

Chief complaints Pain in right kidney region painful and frequent micturition.

Family history. Mother living, was operated on for uterine cancer.

Menstruation negative until six months ago, since then flow is scant.

Marital Married eight years No pregnancy. Husband has pulmonary tuberculosis

Present symptoms Known to have low, movable right kidney for five years In November, 1914, had severe attack of pain in right kidney region, three days in bed. Second attack in February, 1915, pain began at pubes and traveled upward toward kidney, lasting one week, not as severe as previous pain, and she was not confined to bed At this time tubercle bacilli were reported found in urine, by her physician Kidney has grown large and is very tender on pressure Increased micturition for past year, has passed 72 ounces in two urinations, no blood

Cystoscopic examination (by Dr Bugbee) March 4, 1915. Urine cloudy, trigone congested, especially about right ureteral orifice Mucous membrane bleeds easily. Right urine cloudy, left urine amber colored

Ten days after the first cystoscopic examination an effort was made to again pass the catheter with the object this time of securing an X-ray of the position of the kidney, it being quite low, but the ureter had within this short time become so occluded by increased thickening and debris that the passing of the catheter was impossible

Maximum weight 115 pounds three weeks before operation Tires easily

Clinical pathology Urine yellow, cloudy, acid, 1,026, albumin, heavy precipitate, no sugar Microscopic Casts, large amount of pus

Operation, March 16 1915 Ureterectomy Median abdominal incision Uterus found anteverted Left ovary and tube firmly adherent to the pelvic wall and broad ligament Tumbria of tube so adherent to the pelvic wall as to be completely occluded and when separated a small opening was discovered and stretched Right ovary and tube still more damaged as the result of inflammatory process Both organs were firmly adherent to the peritoneum about the enlarged ureter The fibræ were practically destroyed and the tube should have been removed, but because of the urgent request of the patient "to save everything that could possibly be saved" it was left after having opened its extremity and dilated it The appendix was much enlarged and showed evidence of inflammatory action It was firmly adherent to the peritoneal covering of the thickened ureter throughout its entire length It was removed The right ureter was greatly thickened throughout its entire course, dissected from its bed to a point below the uterine artery, cut away, cauterized, proximal free end tucked under the cæcum and ileum, pelvic peritoneal incision closed Abdominal wound closed

Nephrectomy Lumbar incision, renal arteries and veins isolated and tied with plain catgut ureter isolated Kidney with its ureter attached removed

Pathological report Macroscopic examination Kidney slightly larger than normal Surface shows

numerous hemorrhagic adhesions on both poles The pelvis of the kidney is slightly dilated. The ureter is 2 cm long and measures about 7 mm in diameter. The kidney substance is rather pale There are numerous small white spots distributed all over cortex The wall of the ureter is thickened The lower portion of ureter contains cheesy pus

Microscopic examination Several sections of the ureter show that the mucosa is greatly swollen. There are no epithelial elements anywhere in the place of the ureteral mucosa The entire stroma as well as the muscular wall of the ureter shows extensive centers of coagulation necrosis as well as typical giant-cell tubercles Dense round cell infiltration is especially characteristic of the folds of the mucosa Section of the kidney shows that the cortex as well as the ampullary portion contains numerous typical epithelioid cells and giant cell tubercles with necrotic and infiltrated portions There are casts of a number of tubuli uninfected. The lesions are very extensive throughout the entire organ

Diagnosis Tuberculosis of the kidney and of the entire ureter

Post-operative history Recovery uneventful, out of bed on the fourteenth day Primary union of wounds. All symptoms relieved

Cystoscopic examination, April 8, 1915 Mouths of both ureters seen, little congested Bladder normal.

Present history Well and gaining rapidly Capacity of bladder now normal Vaginal examination eight weeks after operation showed marked diminution in size of the vesicovaginal portion of the ureter Vaginal examination six months after operation showed no appreciable thickening of the vesicovaginal portion of the ureter

CASE 3 Miss A J, age twenty five Chief complaints Pain in right kidney region, frequent and painful micturition

Previous history Menstruation, onset at fifteen, profuse, seven days, no pain, regular. General health good

Present symptoms On November 26, 1914, had severe attack of pain under right costal margin, behind Felt very ill for twenty-four hours Did not vomit or have fever Next attack in January, 1915, lasting one hour, followed by sore feeling in right side December 25 to present time has had pain in bladder, very frequent and painful micturition Never has passed blood in urine Has had two other attacks, one in February, the other in March Last attack, duration one hour, accompanied by vomiting Right side tender on palpation Lost 12 pounds from December 25 to March 26

Physical examination negative.

Cystoscopic report (by Dr Bugbee) Urine right side cloudy. Trigone and area about mouth of right ureter congested Mucous membrane bleeds easily

Pathological laboratory report on urine Light

yellow, cloudy, acid, 1.015, albumin heavy, cloudy, no sugar, large amount of pus.

Operation, April 9, 1915. Ureterectomy. Median abdominal incision. Pelvic organs normal. Appendix removed. Left ureter normal. Right ureter throughout its entire course greatly thickened. Freed from its bed and severed below the uterine artery. Proximal free end tucked under cecum and ileum. Pelvic peritoneal incision closed. Abdomen closed.

Nephrectomy. Lumbar incision, renal vessels tied with plain catgut, ureter isolated and kidney and ureter removed together.

Pathological report. *Macroscopic examination.* Kidney, weight 110 grams with ureter, 200 without ureter, dimensions $12\frac{1}{2} \times 6\frac{1}{2} \times 4$ cm., ureter 20 cm. long, largest diameter 1 cm. which is in the lower one third, smallest diameter 4 mm. at the junction of the upper and middle one third. Fatty capsule removed, true capsule peels smoothly except on upper pole, where it is somewhat adherent. At this place there are subcortical typical hamorrhages and yellowish areas representing local abscesses. These cover an area of about $1\frac{1}{2}$ cm. in diameter. On section the pelvis shows irregular areas of erosion with raised outline and yellowish color. One of the pyramids is diffusely eroded, forming a crater about 2 cm. in long diameter. This represents the apex of the infected zone which goes out in cone-shaped manner to the cortex of the kidney. The ureter is diffusely thickened, especially in its lower one third. One section is taken from near the peripheral extremity, a second section from the constricted area of the middle one-third. The contents of the pelvis are thick, creamy pus. The pelvis is somewhat dilated. Section from the pelvis.

Microscopic examination. Section of kidney shows a cortical region with many minute tubercles of typical formation, then comes a wedge shaped area of diffuse tuberculosis where the tubules are entirely destroyed. The apex of this region is toward the pelvis, and shows remains of the straight tubules.

Section of the ureter in the peripheral region shows a diffuse destruction of the mucosa, replacement by lymphoid cells and a few giant cells. The section from the middle constricted region shows an intact epithelium, but some lymphoid infiltration of the submucosa.

Diagnosis. Tuberculous pyelonephritis and ureteritis, universal.

Post-operative history. Convalescence uneventful. Primary union of wounds. Symptoms relieved.

Cystoscopic examination, three weeks after operation, shows the urethra hyperemic, the sphincter hyperemic, the fundus of the bladder normal, an area of hyperemia at the site of right orifice, and several minute grayish nodules scattered through the base of the bladder. Capacity seven ounces. Clear urine from left kidney. Left orifice normal.

Vaginal examination. Nine weeks after operation. The vesicovaginal portion of ureter had

diminished so in thickness that it was with difficulty determined; absolute relief of all symptoms.

CASES IN WHICH THE REMAINING TUBERCULAR URETER AND LUMBAR SINUS WERE REMOVED AT THE SAME TIME

The following two cases are of especial interest because they are of a class which has not received the surgical attention it deserves, although suffering equally if not more than the cases with tuberculosis of the kidney pure and simple.

CASE 4. M. A., age twenty-nine.

Present symptoms. Vesical pain and hæmaturia. Severe pains in both kidney regions referred along ureters to pelvis. Prefers to sleep on her back but rests more comfortably on left side than on right. Constant and distressing discharge in lumbar region from old renal sinus.

Previous history. Had fracture of right hip when quite young. Later right femur became tubercular. Five and one half years ago was operated upon at a hospital for tuberculosis in right kidney and tuberculous femur. Femur was cured but left deformed. Kidney was opened and drained. Menstruation, onset at fourteen. Regular, two and one half days, moderately painful. Last, one week ago. No children, no miscarriages.

Family history. All members of her family have tuberculosis.

No physical examination recorded other than that her general appearance was "fair."

On admission her temperature was 99.2, pulse 72, respirations 22. Urine on admission very dark, amber, acid, heavy cloud of albumin, no sugar. Microscopical examination negative except for red blood cells and squamous epithelial cells, also leucocytes. On day after operation urine was reported "cloudy, amber 1.018, acid trace of albumin, no sugar. Red blood cells, hyaline casts and squamous cells." No report of examination for tubercle bacilli, no report of cystoscopic examination. Seventeen days after operation urine reported "colorless alkaline, 1.002, no albumin, no sugar, no sediment."

Operation. Median abdominal incision. Abdomen opened and explored. Appendix normal, left kidney low. Remains of right kidney high under ribs. Right ureter greatly enlarged, in places to the size of a thumb. Ureter was dissected out under broad ligament to base of bladder ligated and freed above plevic brim where it was tucked beneath the colon. The peritoneum was then sutured over old bed of ureter. Abdomen then closed in usual manner.

Then through scar of previous operation on right kidney, incision was made down to remainder of kidney. Kidney was very small and chiefly a wall surrounding an abscess of caseous material and

seems still. Also no apparent blood supply to pelvis of kidney (this had probably been destroyed at previous operation). Kidney structure and remains of ureter removed, bleeding points ligated and wound packed with three strips of iodo-form lock solution. Wound closed in usual manner.

Pathological report. *Macroscopic examination.* Irregularly shaped mass of tissue weighing 90 grams. Mass contains many cavities and on section shows cystic cavities lined with pyogenic membrane. Ureter 17 cm. long attached, dilated, and filled with pus. Measures on section 2 x 17 cm.

Microscopic examination. Kidney: Areas of necrosis, round-cell infiltration, congestion. Areas of tuberculous tissue in which there appear to be giant cells. Parenchyma of kidney almost entirely replaced by these changes. Ureter: Thickening, round-cell infiltration, loss of mucosa.

Diagnosis. Tuberculous pyelonephritis.

Post-operative history. Condition good. Stomach convalescence for four days. Vomited a good deal. Convalescence thereafter uneventful. First twenty-four hours urine 3½ ounces, second twenty-four hours urine 3 ounces, third twenty-four hours urine 19 ounces. Abdominal wound healed by primary intention, lumbar, after several weeks. Relief of symptoms immediate.

Last report, one year after operation, patient in perfect health.

Case 5. Mrs. E. R. age thirty-eight.

Family history. Negative.

Present symptoms. Painful and frequent micturition. Pain more or less constant, referred to course of right ureter. Pain worse when standing, comfortable when reclining. Distressing and constant discharge from ureteral sinus, lumbar region.

Previous history. Right kidney removed January 12, 1913, for tuberculous report of which is included among separations to be reported. Case 7. Persistence of symptoms for over five months since her last renal operation.

Interfering June 23, 1915. Median abdominal incision. Ureter found greatly thickened throughout its entire course. Freed from its bed, severed below the uterine artery proximal end tucked under osium and lumbar, pelvic peritoneal incision closed. Lumbar incision through scar of previous operation for separations. Trunk of sinus dissected out down to ureter. Ureter and old tract removed together.

Pathological report. *Macroscopic examination.* Length 10 cm., average diameter 1.3 cm. On section large amount of cheesy pus escapes from dilated lumen, which, however, is almost completely closed up with the sticky purulent masses.

Microscopic examination. Ureteral wall thickened with lymphoid infiltration which entirely replaces the mucosa. The wall itself shows many typical giant cells.

Diagnosis. Tuberculous ureteritis.

Clinicopath examination. June 20, 1915, by Dr. Barber. The bladder retains four ounces of fluid with some excretion. The mucosa of the bladder

is normal. The right ureteral orifice is closed. About 1 for an area of 2 cm. is a slightly hyperemic area containing several canaliculi. The blood-vessels are scarce in this area. The bar-fold in the median line has a similar appearance. The left ureter is normal, clear urine is evacuated at regular intervals. The area of the vesical neck and posterior urethra shows moderate edema.

Post-operative history. Abdominal wound healed primarily, lumbar wound after five weeks. Convalescence uninterrupted. Symptoms immediately relieved. Left the hospital weighing 117 pounds. On May 20, 1915, when last examined, weighed 169 pounds, enjoying perfect health. Vaginal examination showed no thickening of the vesicovaginal portion of the ureter.

Cystoscopic examination (by Dr. Bugbee). Bladder retains four ounces. Mucous membrane healthy throughout. Left ureteral orifices normal. Clear urine is discharged at frequent intervals. (Bugbee.)

One of the particularly interesting features of this case is that at the time of her last operation the capacity of her bladder was only four ounces, the walls being damaged by inflammatory action. The bladder capacity at present is just the same as before but the appearance of the bladder is entirely different, and although she cannot hold more than four ounces and frequent micturition persists, yet she does not suffer and is perfectly comfortable except when the bladder is full.

CASES IN WHICH THE KIDNEY WAS REMOVED AND THE URETER LEFT WITHOUT RELIEF OF SYMPTOMS

Case 6. M. C. age thirty-seven.

First examined September 1, 1907. Symptoms frequent and painful micturition with pus and blood. Pain in right lumbar region and at times severe along ureteral tract. An X ray showed stone in the pelvic portion of the right ureter.

Vaginal examination showed a large, thickened ureter along the anterior vaginal wall.

On September 10, 1907, a median abdominal incision was made. The ureter found thickened throughout its entire course, and a phosphate stone filling the lumen of the ureter was removed from the middle of its pelvic portion. A ureteral catheter was passed through the opening made for the removal of the stone into the pelvis of the kidney and three ounces of urine containing pus was withdrawn.

Examination by two pathologists failed to reveal evidence bacilli in either specimen.

Removal of the stone did not relieve symptoms so it was decided to remove the kidney. October 19, 1907, right nephrectomy was performed. Drain-

age placed at the stump of ureter. Immediate recovery, no sinus. Nephrectomy relieved only the distress in the right side. Painful and frequent micturition continued as before. Bladder was injected with guineaonol followed by argyrol and later by iodoform emulsion 5 per cent.

Macroscopic examination. Kidney $8\frac{1}{2} \times 5\frac{1}{2} \times 4$ cm. On section very fibrous. Nothing found in calices or ureter.

Microscopic examination. Section of kidney cortex. Tufts have largely disappeared. Coalescence of tubules. Areas of leucocytes and infiltrations of red cells, scattered tubercles with giant cells.

Diagnosis. Tuberculosis of kidney.

Three years after she was again examined. The bladder, irritable and painful, was in exactly the same condition, its capacity being only two ounces. The ureter could be felt along the vaginal wall just as thick as before operation. The left ureter was catheterized, normal urine secured from the left kidney. At the time of her death from pneumonia, seven years after, bladder symptoms remained the same.

It is my opinion that had ureterectomy also been performed the bladder conditions would have been materially altered, as occurred in the following cases.

CASE 7. Miss K. R., age thirty-eight.

Previous history. Operated upon by Dr. J. Riddle Goffe, December 7, 1912, at which time numerous small fibroids of the uterus were removed, uterine ligaments plicated for the correction of a displaced uterus. Stomach fixed to the abdominal wall for

gastroptosis. Symptoms of painful micturition persisting, further investigation disclose a tuberculous lesion of the kidney. The patient was kindly placed under my care.

Cystoscopic examination, December 19, 1912. Left ureter mouth normal. Right ureter mouth is a red excavation through which dense clouds of turbid and red fluid escape at intermittent periods. Floor of bladder is oedematous and lumpy.

Right nephrectomy, January 10, 1913, done as heretofore described.

Pathological report. *Macroscopic examination.* Kidney with short ureter stump. Cystic cavities in either pole. *Microscopic examination.* Capsule thickened diffuse cloudy swelling of the epithelium. Large areas of epithelioid and lymphoid infiltration with a few definite tubercles.

Diagnosis. Tuberculosis of kidney.

Neither of the two last cases were relieved by nephrectomy, and a contrast of their subsequent histories is of interest. In Case 6 we find that up to her death the vesical symptoms persisted and the walls of the bladder and ureter remained greatly thickened. In Case 7, a continued history of which is found in Case 5, the vesical symptoms were not only relieved after nephrectomy, but the bladder assumed a healthy appearance although its capacity remained the same. The thickening of the vesicovaginal portion of the ureter also completely disappeared.

PARTIAL OCCLUSION IN THE TREATMENT OF ANEURYSMS¹

By EDWARD MARTIN, M D, PHILADELPHIA

FOUR years ago a man, aged forty years, while returning from a Labor Day picnic in that condition of ethyl exaltation appropriate to the occasion, received a dazing jaw-jolt, followed by no effect other than the customary transient lack of initiative. Two weeks later there developed a slowly progressive swelling of the right eye-lid, which in conjunction with a chemotic conjunctiva, a pulsating orbital content, and a subjective bruit, led him to consult an eye man, Dr Risley, who referred him to Dr John B Deaver, who ligated his right common carotid artery, this being followed by an immediate lessening of his ptosis, a cessation of pulsation and bruit, and a prompt and permanent cure.

Two years and eight months ago a man aged sixty-five years, fell downstairs. Seven months later he awoke from a troubled trance, deaf in his right ear, blind except to gradation of light, and harassed by a throbbing tinnitus, for the cure of these ills he consulted an eye man, Dr Risley, who referred him to me. He was a high-pressure arteriosclerotic, with inadequate renal function, and presented a bilateral pulsating exophthalmos with everted lids, and thrill and bruit—more marked on the right side. Moderate pressure on the right common carotid controlled the pulsation thrill and bruit. Under local anæsthesia a doubled chromic catgut ligature, No. 2, was passed around the right common carotid and was tightened down till the orbital pulsation and bruit ceased, a feeble pulse being still felt to the distal side of the ligature. A prominent venous plexus in the orbit was also catgut ligatured. The man was given an injection of human serum, little fluid and less food, for two weeks being kept in bed and in a condition of cheerful resignation by the judicious use of morphine. A report written the last week shows a complete cure, and eyesight adequate for the reading of large print.

Five years and a half ago a man, then twenty-one years old, was struck senseless by a trolley, so remaining for a week with slow persistent bleeding from the nose and ear. For two months he exhibited left facial palsy and deafness in the ear of that side, and constantly then and thereafter anosmia and a loud, humming, buzzing sound in his head, not ceasing for even a fraction of a second, but with a throbbing, rhythmic accentuation. For the relief of the tinnitus he consulted Dr Leopold, who sent him to me—he being then in the second year of his suffering. His left eye was moderately thrust forward. Over it, particularly in the upper orbital segment, were dilated pulsating veins, the eye-lid was a trifle ptosed, and the left external rectus was weak. A loud, ringing, short, sharp bruit could be heard, much like the sound made by tapping a sheet of steel with a hammer. This sound disappeared on making pressure over the left common carotid artery. By means of a tendon ligature, this artery was occluded till the sound ceased, though feeble pulsation of the carotid could still be felt distal to the tie—a mass of orbital veins was also catgut ligatured, and the general serum-starvation, care-free rest treatment already indicated was carried out. Two years later Dr Leopold reported that the cure had been prompt, complete, and continuous.

The usual cause of pulsating exophthalmos is trauma (over 70 per cent, de Schweinitz and Holloway), and particularly that of sufficient severity to fracture the base of the skull.

The symptoms in their order of development are throbbing bruit, distressingly audible to the patient, exophthalmos, dilated orbital veins giving pulsation and thrill, and failure in vision.

The ocular and orbital manifestations are bilateral in 10 per cent of the cases. Symptoms of intracranial hypertension are conspicuous by their absence.

¹ Read before the American Surgical Association, Rochester, Minnesota, June 9-11, 1915.

The diagnosis would seem obvious, yet of 40 autopsies collected by de Schweinitz and Holloway, certain rupture of the carotid into the cavernous sinus was proved in but 14. Six were tumors and 6 were aneurysms of the internal carotid or of the ophthalmic artery.

Aubaret, having ligated both carotids, conducted the logically, but not necessarily, sequent autopsy, finding no trace of aneurysm.

Van Dusen, after a bilateral ligature with reported betterment, demonstrated post-mortem a fibrosarcoma.

There is an unwritten history which would still more forcefully illustrate the possibility of diagnostic error. Hence a careful examination of the accessory nasal cavities, an interpretation of X ray findings, with regard to the rapid bone erosion of new-growths, and an appreciation of the frequent thrill and of the noisier bruit of an arteriovenous aneurysm, would seem to be indicated.

The prognosis as to life seems good, as to vision bad, de Schweinitz and Holloway asserting that not more than 10 per cent have retained normal vision and that there is a pronounced defect in 50 per cent.

That a spontaneous, or perhaps, a traumatic cure may be accomplished they show by the case of a boy whose right common carotid and left internal carotid had been tied by Frazier with some betterment. More than two years later, as a result of butting a playmate, his bruit was lessened the same day, disappeared the next, and thereafter remained permanently well.

The treatment, unfortunately, cannot be conducted on those lines which Matas has so admirably formulated for the cure of accessible aneurysm.

As a means of favoring thrombosis by a local slowing of the circulation, carotid ligature has been extensively used. Lequist observes that while the general mortality of this measure is upward of 20 per cent, as applied to pulsating exophthalmos it is less than 2 per cent (113 cases), and Zeller regards it as almost free from danger. De Schweinitz and Holloway report for this operation, as applied to pulsating exophthalmos, 15 per cent mortality and 10 per

cent disturbances of the central nervous system. Sweet's collection of twenty-five comparatively recent cases includes but a single death, and that an immediate operative one incident to the effort of an ingenious German to ligate the internal carotid, both within and without the skull.

Carotid ligation has been successful in about two-thirds of the reported cases.

A partial occlusion, particularly if it be a temporary one, is necessarily a safer measure in so far as brain function is concerned than one which completely and permanently closes the artery.

Sweet's research shows that arteries, obeying the law of muscular tubes, ultimately discharge into their lumina constricting silk threads. In tendon, catgut, or fascial strip from the patient there is provided material which will occlude long enough for a cure of the aneurysmal condition and which on absorption leaves a normally patent vessel.

As a means of starting a local thrombus, ligation of a dilated orbital vein is given first choice by de Schweinitz and Holloway, who have collected twelve successful cases, some of which exhibited alarming though transitory brain symptoms incident to the too wide extension of the thrombus. Later de Schweinitz somewhat modified his emphatic commendation of this method because of the notes of a fatal case which were sent him. Of five orbital cases collected by Sweet, two recovered, one was improved, and two were failures, one ending fatally.

As a general means of favoring coagulation repeated gelatin injections have been widely used. Sweet shows that three out of five cases were thus cured. Serum is generally regarded as safer and more efficient, and, subject to the test of clinical experience, should supplant gelatin.

The treatment indicated in these cases of pulsating exophthalmos, due to arteriovenous aneurysm, would be, after preliminary tests as to the effect of compression of the carotid: (1) An occlusion of the vessel by an absorbable ligature up to the point of stopping bruit and pulsation. The patient can best testify as to the disappearance of the bruit but must distinguish between a true ear tinnitus which

often follows basal fracture and the rhythmically throbbing noise of his aneurysm. (2) Ligation of one or more dilated orbital vessels. (3) Starvation diet, guarding against acidosis

Little fluid. Bowel evacuations, accomplished without straining, and two weeks rest in bed made, if not alluring, at least bearable by the judicious use of anodynes.

PERINEPHRITIC ABSCESES¹

By WILLIAM F. BRAASCH, M.D., ROCHESTER, MINNESOTA

From the Mayo Clinic

WHILE the subject of perinephritic abscess has been well reviewed in various articles, its exact pathology is still undetermined and the question as to whether a perinephritic abscess may originate in the perirenal tissues without any primary involvement remains unanswered. Perinephritic abscesses have been referred to as primary or secondary those originating in the perinephritic tissues being termed primary, while all others, whether originating in the kidney or some other focus, have been regarded as secondary. The existence of a primary perinephritic infection has never been definitely established either at operation or at autopsy. Because of the large amount of evidence which demonstrates that infection of the perirenal tissues is secondary to infection in surrounding foci, it would be more logical to regard all perinephritic infection as secondary or metastatic. A division may be made between an abscess of renal origin and one arising in other tissues. The former group should be termed true perinephritic abscess, the latter, subdiaphragmatic or retroperitoneal.

A review of the cases operated on in the Mayo Clinic for abscess in the perinephritic tissues lends support to such classification. One hundred and one patients had been operated on up to January 1, 1914, for abscess involving the perirenal area. In 34 of this number it was proved at operation that the abscesses were secondary to lesions in the extra-urinary tissues and because of their situation they were termed subdiaphragmatic or retroperitoneal abscesses. This group has been considered separately in a recent paper

by Judd (1). There remain for consideration 67 with lesions which may be regarded as perinephritic abscess. Of this number, 46 were male and 21 female, or practically a ratio of 2 to 1. In 36 patients the abscess was found on the right side and in 33 on the left, or practically equal. On reviewing the cases the following direct etiologic factors were found in the order of their frequency:

- 1 Pyonephrosis
- 2 Renal tuberculosis
- 3 Nephrolithiasis
- 4 Cortical abscess
- 5 Traumatic rupture.

Pyonephrosis. Inflammatory or mechanical destruction of the renal tissue may exist for years without seriously incapacitating the patient except by occasional attacks of pain. A perinephritic abscess will not infrequently suddenly complicate the situation, and the patient is then forced to seek surgical relief. The abscess is usually drained at once, and the patient may go about for years with a discharging sinus unless the kidney is removed. Pyonephrosis was found as the source of perinephritic abscess in 12, or 19 per cent. of the 67 cases. Of this number, 3 were large infected hydronephroses of long standing. Immediate nephrectomy was done in 10 cases and drainage with subsequent nephrectomy was done in 2. The value of cystoscopic examination is rendered apparent in that the nature of the lesion and the functional destruction of the kidney was determined prior to operation. Drainage alone in these renal lesions is frequently attended with various complications, and subsequent nephrectomy may be rendered difficult.

¹Read before the American Association of Genito-Urinary Surgeons, White Sulphur Springs, May 18-20, 1915, and the Southern California Medical Society July 18, 1915.

Renal tuberculosis. Renal tuberculosis as the apparent etiologic factor of perinephritic abscess was present in 10, or 15 per cent, of the cases. Evidence of perirenal infection with renal tuberculosis is often found at operation and, while it is more often characterized by the sclerotic type, the formation of abscess not infrequently occurs. Severe pain occurring with renal tuberculosis may be the result of mechanical obstruction in the ureter and is usually transitory in character. With perinephritic complications the pain more often remains continuous over a period of weeks. It is not usually so acute as with other types of perirenal abscess, nor are the other symptoms so marked, the temperature and the leucocyte count being considerably lower. The prognosis of perinephritic abscess accompanying renal tuberculosis is less favorable than with other forms of perirenal infection. Of the 10 cases operated upon 6 died within a few months after operation. In seeking the cause of the development of perinephritic abscess with renal tuberculosis it may be inferred that it is the result of secondary mixed infection. In 3 cases, however, no bacterial growth was reported on culture.

Nephrolithiasis. With stone in the kidney or ureter the pain is usually intermittent in character. When the pain persists over a period of several days or weeks, it is the result either of continuous urinary obstruction or of perinephritic abscess. The perinephritic abscess frequently brings the patient suffering from nephrolithiasis to a surgeon when the occasional colic will not. Nephrolithiasis was the direct cause of perinephritic abscess in 11, or 16.4 per cent, of our cases. In each there was a cortical abscess, the evident result of the stone, which in turn was the evident cause of the perinephritic infection. The appearance of the perinephritic abscess was usually marked by a continuous severe pain persisting for several days or weeks. In a number of cases, however, there had been no recent clinical data suggestive of any complication. The abscesses in these cases were small and had burrowed into the perirenal fat. Nephrectomy was performed in 6 cases, while nephrolithotomy and drainage

of the perinephritic abscess effected a cure in the other 5 cases. It is an interesting fact that the cases in which the perinephritic abscess was directly connected with a cortical abscess healed merely by draining the perinephritic abscess. This apparently explains why drainage of the perinephritic abscess may suffice to cure the condition even though a cortical abscess be the underlying cause.

Cortical abscess. Direct evidence of acute localized renal infection, other than with pyonephrosis, lithiasis, or tuberculosis, as an etiologic factor in perinephritic abscess was found in 12, or 18 per cent, of the cases. Pus in varying amounts was found in the urine in all save 2. Eight of the patients were subjected to cystoscopic examination, and the urine catheterized from the affected kidney showed microscopic evidence of infection. Of considerable interest are the 2 cases in which repeated analysis of the urine failed to show any marked pathologic element save a trace of albumin and a few hyaline casts that were regarded as of no practical significance. At operation, perinephritic abscesses were found in direct communication with single small cortical abscesses. Recovery of the patients followed simple drainage. In 4 patients but a single cortical focus could be ascertained at operation, 3 of these recovered after drainage, the fourth suffered from a recurring abscess a month later. In 2 cases multiple cortical abscesses were found and nephrectomy was performed. The clinical symptoms in this group were characterized by their severity, evidence of marked infection being present in all. The leucocyte count was high and varied from 15,000 to 34,000.

In the discussion of this group of cases it is of interest that none of our series of perinephritic abscesses was found to have originated from a primary pyelitis or pyelonephritis. In the 211 cases of pyelonephritis and pyelitis which have come under our observation, there is no record of previous perinephritic abscesses. Chronic pyelonephritis or pyelitis is therefore an infrequent cause of acute perinephritic infection.

Traumatic perinephritis. Perinephritic abscess not infrequently occurs as a complica-

tion of traumatic rupture of the kidney, usually from one to three weeks following the injury. It occasionally follows severe injury to the loin even when there is no clinical evidence of renal rupture. Albarran's well-known experiment demonstrated that perinephritic abscess may be caused by trauma directed to the perirenal area. It might be inferred, however, that perinephritic abscess following such injury may result from a rupture of the kidney too slight to give clinical evidence. It is well known that the kidney may be ruptured with a slight injury only. It is not impossible that the source of many perinephritic abscesses following injury to an affected loin is a superficial rupture of the kidney with secondary infection. Perinephritic abscess complicating rupture of the kidney was found in 4 or 6 per cent of our series. In 3 cases nephrectomy was necessary; in 1 case in which an abscess followed rupture of an upper pole drainage alone was done, the patient making an uneventful recovery.

Perinephritic abscess without renal involvement. There remain 18 patients in whom no evidence of renal involvement was ascertained on clinical examinations. Two of this group had symptoms suggestive of possible spinal involvement and one later developed a typical psoas abscess. Another patient gave some evidence of possible pelvic source of infection which leaves 14, or 21 per cent, of patients with no data as to the source of the infection. In many of this group the more recent methods of examination were not employed. Doubtless, with the aid of these methods, some evidence of renal involvement would have been found in a considerable percentage of these cases. There will be, however, a small group of cases in which no evidence of renal infection is found on clinical examination and the etiology of which may not be ascertained at operation because of the exigencies of the cases. This type of perinephritic abscess is usually more acute and in all probability forms a comparatively large proportion of the perinephritic abscesses seen in the emergency hospitals of large cities. It would seem logical to infer that a small solitary cortical or subcapsular abscess is the

cause of these unidentified perinephritic abscesses. The frequency with which hematogenous infection subsequent to some superficial lesion occurs in cases of both renal and perirenal infection would suggest their close relationship. It is this small proportion of perinephritic abscesses which has been regarded as primary, because the evidence of renal involvement ascertained by means of the data available at operation was necessarily incomplete. It is in recent years only that the importance of several methods of clinical examination has been realized in the diagnosis of perinephritic abscess. With the aid of these methods, the renal origin of such abscesses will be found more frequently. The diagnosis of perinephritic abscess would be inexact without the data obtained through the following methods:

- 1 Repeated urinalysis
- 2 Bacteriologic examination of the urine catheterized from each kidney
- 3 Estimation of the comparative renal function
- 4 Radiologic examination, including that of the urinary tract of the thorax, and pyelography

Urinalysis. Israel (2) has called our attention to the value of repeated examinations of the urinary sediment in determining the renal origin of perinephritic abscess. He maintained that a few red blood-cells and pus-cells, together with albumin and occasional casts, may be found after repeated examination in practically every case of perinephritic abscess. On the other hand, it must be remembered that a few red blood cells and pus-cells may be found in the urine as the result of a coincidental lesion existing in the lower urinary tract, which fact lessens its diagnostic value. The absence of red and white blood-cells in the urine would not necessarily exclude the possibility of renal origin. A practically negative urinalysis was reported in 10 of the 14 cases of unidentified perinephritic abscess. In a number of these however but one urinalysis was made. On the other hand, in the series of 34 subdiaphragmatic abscesses of definite extrarenal origin reported by Judd (1), red blood-cells or pus-cells were found in the urine in 3 cases, the origin of these cells

being in all probability in a coincidental chronic urethritis, trigonitis, or prostatitis which might be difficult to determine clinically.

Bacteriologic examination. Baum (3) reported 7 cases of perinephritic abscess, in all but one of which staphylococci were present in the urine. Although it has been demonstrated that bacteria, and particularly staphylococci, may pass through the kidney and be found in the urine without any renal lesion being present, the proportion of such cases is very small. Baum's report is one of exceptional interest and suggests a method which should be of considerable value in determining the renal origin of perinephritic abscess otherwise overlooked. The accuracy of this report is corroborated by numerous control tests, and by one case in particular, where the same organism was obtained from a cortical renal abscess as appeared in the perinephritic tissue. We have tried the method in 6 cases, in 4 of which staphylococci were found in the urine, in 2 cases the urine was negative on culture, and in one of these a retroperitoneal abscess extending from a perforated duodenal ulcer to the perirenal region was found at operation. In 2 cases a differential culture of the urine catheterized directly from the kidneys showed staphylococci from the affected side only.

Renal functional test. If a renal lesion is the cause of perinephritic abscess, a comparative diminution of functional activity from the affected kidney must follow. Although the cortical lesion may be slight, an appreciable difference should be noted between the functional output of the two kidneys. Using phenolsulphonethylphthalein, which lends itself admirably for this purpose, we have demonstrated a well marked diminution of dye return from the affected side in 5 cases. (This number includes 3 cases reported in a previous article [4].) In one of these the microscopic examination of the urine was practically negative save for a trace of albumin. In a case of retroperitoneal abscess involving the perirenal area and secondary to duodenal ulcer, no difference in the functional activity of the two kidneys was found. In one case of chronic perinephritic abscess of

probable renal origin the difference was too slight to be of practical value.

Radiographic evidence. Röntgen examination of the urinary tract must necessarily be a preliminary step in every case of perinephritic abscess. It must be emphasized that a well-marked etiologic lithiasis may be present without causing preliminary subjective symptoms. Röntgen examination of the lower thorax, made in order to observe any abnormal change in the position of the diaphragm, may be of considerable practical value in differential diagnosis. This is particularly true on the left side where both a perinephritic and a subdiaphragmatic abscess may be the cause of considerable displacement.

Pyelogram. Renal infection past or present usually leaves some evidence of its presence in the outline of the pelvis or ureter which can be rendered visible by means of the pyelogram. Very recent infection may not, however, cause sufficient change in the pelvic outline to be of diagnostic value. The pyelogram was of considerable value in 2 of our cases where the clinical data suggestive of renal involvement were indefinite.

Differential diagnosis. It may be difficult on clinical examination to differentiate perinephritic abscess from acute septic nephritis. In the early stages of abscess development the symptoms of the two conditions may be quite similar, both may be characterized by high temperature, leucocytosis, severe pain, and tenderness referred to the affected kidney area. However, with the increase in size of the perinephritic abscess palpation will usually determine the condition. Although the existence of an acute perinephritic abscess may easily be determined chronic perinephritic abscess may remain unrecognized until revealed at operation.

It may be difficult to differentiate between a subdiaphragmatic or retroperitoneal abscess and true perinephritic abscess. As a rule, symptoms of the original lesion and a more general invasion of the tissues will differentiate the two conditions. The data obtained through urinalysis, cystoscopic examination, bacteriologic examination, renal functional tests, and the roentgenogram are often of considerable aid in differentiation.

Results. Of the 67 patients operated on at the Mayo Clinic, only 2 (3 per cent) died as the result of the operation. Three other patients were reported dead at three, seven, and twelve months, respectively, after operation.

The subsequent course was ascertained in 51 of the remaining patients. In 18 of this number the wound had healed in less than a month after operation. Of the remaining patients, 16 continued to drain for two months, 6 drained for three months, and 3 drained as long as six months after operation. The fistula persists to the present date in 4 patients, all of whom drained longer than six months. In 2 of these patients an etiologic renal lesion was ascertained at the time of drainage and subsequently nephrectomy was advised. In the other 2 no evidence of renal lesion was discovered on clinical examination, however, the more recent clinical tests were not employed. One of these patients, drained one and one-half years ago,

has returned with cystoscopic evidence of an etiologic renal lesion not previously discovered.

The question is frequently raised at operation whether immediate nephrectomy or drainage of the abscess alone is indicated. In the presence of a large fluctuating abscess and marked physical weakness drainage will suffice; if, however, evidence of considerable renal involvement has been ascertained, immediate nephrectomy as well as drainage is to be preferred when possible. The practical importance of previously ascertaining the underlying renal condition is self-evident.

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OBSTETRICS, A LOST ART

A CRITICISM OF THE PROMISCUOUS INDICATIONS FOR CÆSAREAN SECTION¹

BY RUDOLPH WILSLER HOLMIS, M.D., F.A.C.S., CHICAGO

THE basis of this paper is not so much the impression derived from a perusal of the literature as it is the opinion substantiated by personal discussion with obstetricians whose judgment is worthy of the most serious consideration. Repeatedly it has been stated in these private discussions that the indications for cesarean section have been inordinately broadened until very largely they have assumed a dangerous, if not a ridiculous, aspect. The teaching and the practice therefrom at the hands of the unthinking, is a pernicious one, and should be curtailed. The fundamental principles embodied in this paper belong to the writer, yet to a great extent they likewise belong to others. The fact that the opinions are not strictly personal leads him to believe that the discussion is pertinent at this time.

There may be no question that the attendance upon the woman in labor antedates all other medical and surgical activities, during the period when medicine was developing into a system of empiricism, surgery had little to commend for itself, and during this same period obstetric knowledge was enormously advanced by those pioneers who found operative work upon the parturient woman an inviting field. During the closing period of the seventeenth century, on through the eighteenth and into the nineteenth hundred years, manual dexterity was developed to a degree which is too little appreciated in these times. We see the discovery of version by Ambrose Paré developed to a high degree by his school, we see the facility of breech extraction enhanced by the recommendations of Mauriceau, Deventer, Smellie, Wiegand, and others, then forceps came into being by the ingenuity of the Chamberlain family, perfected in many essentials by Smellie, Levret, Hubert, Simpson, and Tarnier, which discovery largely superceded in practice the teaching of the versionist school, still later we see correctional procedures developed to

a really high art by the contributions of Baudelocque, Schatz, Thorn, and Ziegenspeck; in this connection, too, we see Braxton Hicks mature a maneuver by which the child may be turned by digital means; then, again, we see the development of our knowledge in the production of dilatation by the manual methods of Harris and Edgar, by the instrumental method, of which the Bossi appliance is the prototype, in this same period Dührssen revived cervical incisions, which were so ably practiced by Blundell a half century before, and, finally, Dührssen and Aconci presented us vaginal cesarean section as a climax. Then the combination of the discoveries of general anesthesia and asepsis have placed it within our power to cover the operative field of obstetrics painlessly and safely for the mother, and thereby with enhanced safety for the child. These two boons, which aptly have been denominated two of the "modern seven wonders of the world," carry their curse in permuting an unreasonable widening of the scope of this operation cesarean section. Within the past thirty years the general rules of conduct have been so clarified that we may truly state that no department of medical knowledge has been so definitely and positively placed in the domain of an exact science and art as has been the case with obstetrics. As the writer reads the voluminous case reports and essays on cesarean section in our current literature and has narrated to him the case reports which never will be published as they were not justified by scientific teaching, he wonders whether we are drifting. Are we attempting to minimize the precepts and examples of the past masters in the art or are we attempting to ride rough shod past all obstetric rules in the hope of formulating the axiom that the quickest way out is the ethical way? He believes that within a brief period there will be a revulsion of feeling, and the surgical propensities of the present

¹ Read before the Chicago Gynecological Society, June 1913. (See discussion p. 663.)

will be enormously curtailed. In this place it can but be well to quote one who has done much to popularize cesarean section as a sort of makeshift for real obstetric practice.

"With the operation thus shorn of its terrors, it is no wonder that it is being more and more resorted to, where, for one reason or another, the passage of the child through the birth canal is attended with difficulties. But this very ease of performance with its accompanying good results, like almost every abdominal operation, has led to the abuse of the operation, not merely in the number of unnecessary operations performed but in the kind of cases subjected to cesarean section. . . And out of this discussion will finally come the knowledge of the true place of the operation in obstetric surgery." Today the medical profession is seized with the same *furor operatus* for cesarean section as obtained a quarter of a century ago in the case of oophorectomy.

The writer holds that there is essentially one, and only one, scientific indication for cesarean section, and that is where there is such pelvic contraction that it is quite impossible to secure a living child by any other means, here all obstetricians are unanimous in their teaching and practice. It is consistent practice to hold that as the risks of craniotomy or pelvic separation, or even high forceps, are so great when the pelvis is markedly diminished in size — that is, down to six and a half centimeters — that it is wise to extend the absolute indication for a cesarean section to seven, or even seven and a half centimeters. And yet, in the old days, when craniotomy was more prevalent than now, he has wondered, after the stress of a difficult and dangerous operation, if it were not well to advance even our limit for the absolute indication to a higher point — even to eight or eight and a half centimeters, *when the baby is alive, and the mother in good condition, and free from a potential risk of infection*. We know a pelvic contraction of this degree persists inevitably during the woman's life, we have a reasonable, practically a definite, certitude that no child the given woman will bear will be other than disproportionately large, therefore, the same difficulties will be

present in each labor. However, it must be constantly borne in mind that some women habitually bear small children, and though the pelvic contraction be material, there is no disproportion to be considered. In this connection, there is a vivid picture of the woman upon whom the writer did a prophylactic version, and breech extraction twice, and a colleague likewise delivered her by the same procedure in a third labor, and all the babies did well.

On the other hand, when the pelvis has a contraction whose index is above seven and a half centimeters a domain is entered which is fraught with many problems. There are so many factors concerned that the writer holds that it is questionable practice for any, unless he has a close and intimate knowledge of pelvic mensuration and fetal palpation, and has an accurate knowledge of the parturient woman in normal and pathologic labor, to attempt to lay down indications for cesarean section. A surgeon, gynecologist, or general practitioner who has not had that experience and practice from a continued obstetric clientele has not the matured judgment or qualification for the interpretation of conditions and indications for a cesarean section, not alone in this connection, but in the placing of the indication for the operation in any of the specious reasons for a section. The mere fact that a woman has a minor pelvic contraction is no warranty for a section. The evidence of a disproportion must be weighed, the character of the uterine activity must be estimated, the status of the soft parts must be considered, and, too, her surgical risks must be properly balanced. It is a common experience of all trained obstetricians that many a time, the pelvis having a minor contraction, labor pains will be ineffectual during the first stage, due to the fact that the presenting part is prevented from pressing upon the lower uterine segment sufficiently to arouse the characteristic phenomena of labor. The head will float above the brim, suggesting a true cephalopelvic disproportion, and the unwary will deem this as amply justifiable for a section, while the initiated will know that watchful expectancy will be followed by active con-

tractions. *After the membranes have ruptured*, engagement will take place with proper molding, and eventually a spontaneous birth will take place, or, perforce, a simple forcep extraction. It is impossible to quote offhand as to the frequency of such an occurrence in private and hospital practice where it is the writer's rule that all women who have a contraction to nine centimeters, or *below*, are permitted to enter labor. The course of labor is controlled by abdominal palpation and rectal examination. By this method, even where Müller's and Kerr's maneuvers suggest a real disproportion, it is surprising how readily the head eventually will descend. If there be no descent, the writer holds that it produces no jeopardy to the woman or child if we await even the rupture of the membranes for then only will the lower segment guide the head into the brim. *It is not so much the fact of the rupture of the membranes which determine an infection after the cesarean section as it is due to vaginal examinations, which mean the introduction of the finger within the lower segment and over the exposed crown of the head.* It should be held as an aphorism that vaginal examinations always are a potential source of infection in labor, and particularly when a section is under advisement.

It is a digression, but it is deplorable that physicians in obstetric work have not schooled themselves to make their necessary vaginal examinations in pregnancy, and then to limit further pelvic investigation by rectal exploration in labor. Following this custom it is surprising how well conditions may be properly interpreted by rectal means. To be sure, certain factors will be impossible of discovery unless vaginal examinations are made. Fortunately, generally these doubtful points are inconsequential in most cases where the possibility of a section is under advisement. Further, it is essential that a careful study of the contractions should be made, their effect on mother and child should be noted, the maternal pulse should be watched and the fetal heart rate determined by repeated examination. It is self-evident that the first signs of cardiac acceleration is indicative of maternal exhaustion, any elevation of

temperature is strongly suggestive of an antepartum infection. A section performed with these signs present, promises a high maternal death rate. It would be infinitely preferable to remove the child through the parturient canal, by such operation as expediency will suggest, than subject the woman to a great danger of death by an ill advised section.

Again, it is a great error to run precipitately to a section because there is a seeming cephalopelvic disproportion. It is known that minor cephalic displacement, or mal position, will retard descent of the head. An occiput directed to the rear, the R. O. P., for example, characteristically has the head floating until labor is well advanced. What a parody on good obstetrics it is to do a cesarean section; but it has been done repeatedly, when a manual rotation and fixation of the head would answer every purpose. Some of you may recall that one of our eminent gynecologists, called in consultation on a breech case in a multiparous woman who always had had easy labors, performed a cesarean, as the breech had not yet entered the brim, not knowing that such was a characteristic phenomenon of the normal breech.

In recent years a cursory reading of current literature will demonstrate the frequency that cesareans have been done for face, brow, occiput posterior, transverse presentations, that rightly should have been treated by obstetric art. How frequently we read case reports where no mention is made of the pelvic contraction or if mentioned, the degree of pelvic contraction is omitted, where, perhaps, stress is laid on the fact that the external measurements were diminished, but no mention made of the pelvic capacity, when all obstetricians of experience know that external pelvimetry is essentially worthless for the determination of actual internal pelvic deformity. Certainly there is a crying need for a more widespread experience in internal mensuration. In the absence of this knowledge, how is it possible to interpret the indications for operation? It would be infinitely preferable, if we have a difficulty in labor, to test the primiparous woman, and if peradventure the child should be lost then

if necessary perform the section in the subsequent labors. But it must not be forgotten that a first labor may be ever so difficult and the later labors of surprising ease. This is as true of women with minor pelvic contraction as it is of the truly normal. To have performed a section in the first labor, and doom the woman to cæsareans forever after, is small warrant, when perhaps the trouble was really due to tense soft parts, or a minor deviation of presentation.

TUMORS OBSTRUCTING THE BIRTH CANAL

These matters are so broad that it would be quite impossible to cover them adequately within the limits of this paper. They are mentioned merely to state that many times watchful expectancy may bring the most happy results. To make a practice of cæsarean section in each instance is to be ruthless in operating. If the woman is seen in pregnancy with an ovarian tumor it may be best handled by timely removal, and gestation be allowed to go to term, if miscarriage should take place it is a lesser calamity than to allow her to go to term, do a cæsarean section, and compel her to submit to a like procedure in each subsequent labor on account of the vulnerability of the uterine scar. Oftentimes, when the ovarian tumor is first discovered in labor, the conservative and proper course, when the tumor does not interfere with the descent of the head, is to deliver from below, and later remove the tumor by laparotomy when conditions are more favorable. Per contra, when the tumor does obstruct labor, then the judicious procedure is to do the cæsarean section, followed by the ablation of the cyst.

A fibroid, which generally means hysterectomy when treated surgically, should not be removed in pregnancy unless distressing or dangerous symptoms develop. The danger signs are necrosis, hæmorrhage, infection, or pressure. If the fibroid, at term, does not obstruct the birth canal the wise conservatism is to deliver from below, and later treat the woman as expediency demands. It must not be forgotten that often uterine tumors are true myomata which hypertrophy with the advance of pregnancy, and involute

pari passu with the uterine retrogression, to a complete disappearance. To perform a cæsarean, when the tumor does not obstruct labor, then do hysterectomy, for this type of tumor is to rob the woman of future child-bearing, and is not judicious surgery. The fibroid or ovarian cyst which blocks the birth canal is as truly within the domain of an absolute indication for cæsarean section as is a like degree of pelvic contraction; but in the case of the cyst, its removal obliterates the indication in subsequent labors, yet the necessity, due to the uterine scar, demands the same procedure in each labor.

ECLAMPSIA AND CÆSAREAN SECTION

In recent times much has been written of the treatment of eclampsia by cæsarean section. The writer believes this is an egregious misnomer. A surgical operation is not the treatment of eclampsia. No one may gainsay that much is gained in the treatment of an eclamptic by the opportune early delivery, but the manner of consummating that delivery is not the treatment, it is the fact that the ovum is eliminated from the uterus. In all the discussions of this aspect of the question, much is stated about the technique of the operation, the number of the convulsions, and general discussion of statistics, but the essential treatment, as we see it today, is utterly ignored. All the polemics on the possible methods of delivery leave out *in toto* the question as to what anæsthesia was used, what measures were instituted before and after operation to secure elimination from the bowels, skin, and kidney; if venesection were employed, if sedatives were exhibited alone or in combination with veratrine viride. Without these complex problems, an argument as to whether this or that procedure was employed for delivery is really specious. Further, who has thought that perhaps a series of thirty cases without a death may not have been due to variations in climatic conditions, as Stroganoff maintains, or seasonal change in diet—or what not? How else do we explain Stroganoff's 113 cases with a maternal mortality of 5.31 per cent against the usual figures of 20 or 25 per cent? We can but take Reuben Peterson's figures to

show the futility of making favorable deductions from the use of cesarean section, in his paper on "Vaginal Cesarean Section for Eclampsia," of 530 cases, 124 died, a mortality of 23.4 per cent; in his paper on "Abdominal Cesarean Section in Eclampsia," of 500 cases, 174 died, a mortality of 34.8 per cent. Can it be debated that the substances which produce the convulsions of pregnancy is other than a systemic paralyzant? Is this not shown by the dry harsh skin with the difficulty of securing diaphoresis, the impossibility, at times, of securing alvine discharges, the suppression of urine, and the blunted if not completely obliterated sensorium? We know that women do not withstand the shock of an abdominal operation as well as when a parallel procedure is done by the vaginal route; we know that abdominal operations do produce now and then a paralysis of the splanchna, as evidenced by the bowel stasis or adynamic ileus, and the suppression of urine. To crowd an abdominal operation upon a woman already with abdominal shock, or better, perhaps, saturated with a paralyzant poison, appears not to be either good surgery or obstetrics.

Unquestionably this explains as much as anything the reason why there is a 11.4 per cent greater mortality by the abdominal route than by the vaginal. Why not return to the simple procedure of Philander A. Harris which so fully meets all the needs in the vast majority of cases? Is it because so few obstetricians know the real method of Harris' digital dilatation? In a great measure this must be true, for the illustrations and descriptions in the textbooks are wrong—even the illustrations in Dr. Harris' own paper are not true, as he himself told me sometime before he died.

We could not question the expediency, yea necessity, for the performance of cesarean section under certain conditions in the eclamptic woman. When it is done it should be fully recognized that it is not the eclampsia but the contributory factors which force the operation upon us. The combination of a minor pelvic contraction with eclampsia, the presence of rigid soft parts, placenta

prævia, or pelvic tumors, properly would sway the mind in this direction; for each of these enormously influences the quickness with which a delivery may be consummated.

PLACENTA PRÆVIA AND CÆSAREAN SECTION

You may recall that two of the first practitioners who employed cesarean section for placenta prævia had their own views as to when one of two methods was to be used. One stated in 1882: "I would recommend cesarean section, if a man had performed or assisted at 200 abdominal operations and the mortality was below 75 per cent, as a substitute to Hick's version, or the alternative measure—if a surgeon is not at hand—do version." The other states: "For the successful performance of version an obstetrician having the necessary experience (performance of 50 versions, for instance being considered sufficient experience) is not so readily obtainable." Then we have the well known surgeon who candidly admits he did the abdominal operation for placenta prævia as he knew its technique and did not know how to do a version. In my previous contribution on cesarean section for placenta prævia we showed that the maternal and fetal mortalities for this method of treatment was 20 and 36 per cent respectively, the obstetric treatment gave a majority of 7 and 55 per cent respectively. As previously shown, cesarean section saved one baby for each woman who was killed by the procedure. There may be no question that the abdominal operation is a ready means of evading certain complications of placenta prævia, and at times should be the only resort considered; but the writer is convinced that the practice of some operators of making it the only means of delivery are assuming a burden of which they in later maturity of judgment will regret. At the present time, their teaching is a pernicious one. As a working hypothesis, one or more of the following conditions should obtain for the proper performance of cesarean section for placenta prævia.

1. *A contracted pelvis.* In an absolutely contracted pelvis the prævia is merely an unfortunate complication. In a relatively con-

tracted pelvis, the possibility of watchful expectancy is not to be countenanced—delay may mean the death of the two patients. On account of the difficulty of operating through a diminished birth canal the bag therapy or Hicks' version are fraught with such difficulties that cesarean section probably, definitely, would be the operation of election.

2. *Cervical rigidity* This is largely a specious argument for, as shown in our previous communication, it is one of the rarest complications of placenta prævia, hardly one case in a thousand is likely to have it.

3. The pregnancy should be near term, and the child in good condition. Subordinate to this, there should be such a status of affairs as to make a section advisable, though not technically a correct indication, a woman may have been sterile many years, late in life, perhaps at the climacteric, she may conceive, go to near term, and have a complete prævia. In such an instance a section would be expedient. However, this reason is so elastic that it easily may be used to sway the operator one way, as an argument for the "therapeutic abortion" may pull another man toward doing the woman's behest.

4. The fact of a *marked* prævia should be determined, the necessity or advisability for the section be fixed, then an interval of some days should elapse whereby the risks of a potential infection introduced by the examining finger may be eliminated. During this interval the woman should be in a hospital. It is dangerous to examine repeatedly, perhaps attempt dilatation, then resort to the section.

5. There should not be a retraction of the lower uterine segment, for the paralysis of the lower segment may determine a post-partum hemorrhage, produced by a true paralysis of the placental site.

INDEFENSIBLE INDICATIONS

Many a cesarean section has been done for indications which have been exceedingly specious, indications which are far fetched. These cesareans never will be reported, for there was no real justification for their performance. Many of these operations are

exemplifications either of the lack of judgment in placing indications, or of ignorance of true obstetric facts. Many a time, as rumors are bandied about of a cesarean section being done for strange reasons we could not question the surgical ability of the operator, but we must concede their lack of obstetric equipment. It is not right for the surgeon, gynecologist, or others, to lay down the indications for a grave obstetric procedure when he, perhaps, never had had an obstetric experience, or his limited experience may have been obtained many years before. It is a pernicious system and looks not for the best interests of the patient. At least he should defer to the judgment of the obstetrician, to the man who has an abiding interest and contact with the specialty. And yet it is not alone the man whose training fits him for other fields of medicine who is forgetting the obstetric principles, but too often the obstetricians themselves have wildly seized upon cesarean sections as a ready and quick means of getting through with a case. How easy it is to spend some thirty minutes in performing a cesarean, and how hard it is to perform a Hicks' version or perhaps introduce the bag, and then to await the time for the work to be completed, sitting up half the night perhaps. How loath the gynecologist is to give up to his assistant even a minor thing like the simple perineorrhaphy, and yet too often the complicated obstetric case is left to the tyro of the clinic because it is "coming off" in the small hours of night.

Let us just present a few of the indications which have been gathered in the course of informal obstetric talks. Perhaps you may say they are mere rumors, but each one was narrated by the one who knew the facts, or they have been culled from the literature. Within the last few days, a physician, in all seriousness, stated he was about to do a cesarean (and he did it a day or two later) on a woman, seven months pregnant, with a pyelitis, his defense being that the vulva was contaminated by the colon bacilli which were the etiologic factors of the kidney disease, she having a badly torn perineum. The baby died promptly. Not so long ago

a surgeon did a section on a woman who had been in labor from Monday to Friday evening. As the head was deeply in the pelvis he perforce did a symphysiotomy to withdraw it. The most miraculous thing of all, the mother and baby survived! Recently we saw in the literature the report of two cesareans for primary inertia. Whither are we drifting when face, brow, occiput posterior, transverse presentations, prolapsed cords are treated by cesarean section? Only the other day, a physician asked why a cesarean was not done on a primipara, with kidney of pregnancy, in the eighth month instead of introducing the Voorhees bag—and this in a woman with a normal pelvis and soft parts. What can you expect of medical students when they see more cesarean sections than they do of any of the ordinary obstetric procedures? Can it be wondered at that they lose the perspective and even recommend that *cesarean section be done for post partum hemorrhage*? What can we expect when right and left cesareans are being done after repeated questionable examinations have been made, and where attempts at delivery are made which maim if they do not kill the child?

It may come about occasionally that there may be such a combination of circumstances, or of complications, which, each alone, would offer no justification for a section, yet the complexus of conditions may make a section the lesser of evils, but such should be preceded by adequate consultation.

In conclusion it should be recognized as a cardinal principle that a contracted pelvis alone is the real indication for a cesarean section, for pelvic deformity alone is definitely certain to obtain throughout the woman's life; the indication which prompted the first section will demand it in each subsequent labor. The treatment of a fibroid certainly will determine her sterility, so the woman is no longer considered in an obstetric relation. On the other hand, in the case of eclampsia, placenta prævia, ovarian tumors, and the many other complications which necessarily or unnecessarily may have been managed by cesarean section leaves the woman in a precarious state if another pregnancy should

occur. No one knows the frequency of rupture of a cesarean scar, for too often the accident happens, not in the practice of him who made the operation, but in the hands of unskilled aid, so is not recorded. We know that A. Davis had three ruptures in 180 sections, so at least one section in 60 is to be followed by rupture in a later labor. This danger is a real one, and must be clearly appreciated by him who contemplates a section on debatable grounds. Those who now are advocating cesarean sections for placenta prævia, eclampsia, etc., must bear the culpability for the deaths which may result from the uterine rupture at a later time. In estimating mortality percentages, such deaths must be credited to the primary operation, not placed in a class by themselves. It has been claimed by many if they themselves or other skilled operators do the suturing that no loss of continuity can occur. This is absurd, for none, however skilled or careful he may be, can vouch for the absolute durability of his suture, can estimate the phagocytotic influence of the uterine wall. Can anyone imagine a more unhappy plight of a primiparous woman who has been treated by a cesarean section for eclampsia or placenta prævia, with a perfectly normal pelvis, who is, and should be, perforce, doomed in all her subsequent confinements to the same abdominal surgery?

It should be an obstetric aphorism that a *cesarean section once is a cesarean section always*. It is but necessary to mention that Franz Jardine, Cameron, and others have expressed this dictum. The only exception should be in a multipara who has born a child through the parturient canal, with normal pelvis and relaxed soft parts, and her labor should be controlled in a hospital.

CONCLUSIONS

- 1 A contracted pelvis alone should be considered as the single definitely permanent indication for cesarean.

- 2 No cesarean should be considered, unless the baby is in good condition, unless it is the only resort.

- 3 *Per se*, eclampsia, placenta prævia, or other specious indications do not offer war-

ranty for the operation unless there be some contributing obstetric anomaly.

4. All women with a relative indication (pelvic contraction) should be allowed to go into labor so she may have a real *test of actual cephalopelvic disproportion*. During this test no vaginal examinations should be countenanced, but labor should be controlled by abdominal palpation and rectal examination.

5. It is neither wise nor expedient to permit a patient with an absolute indication or where it is a repeated section, to enter labor.

6. A cesarean scar is a vulnerable point in the uterine wall, and is likely to rupture; therefore, a cesarean section once is a cæsa-

rean section always. The only exception worthy of consideration would be a multipara with soft, lax, or torn pelvic floor.

7. Cesarean sections have been performed on inordinately broadened indications which in many respects are not defensible. The indications should be restricted.

8. Obstetric manual dexterity has been compromised by the development of cesarean section. The beneficial results from obstetric procedures should be emphasized.

9. One who has a mortality of 5 or more per cent for his cesarean sections should revise his indications—should use discrimination in his selection of cases.

CHANCER OF THE CERVIX UTERI

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FOR obvious anatomical reasons the primary syphilitic sore in women is very apt to remain a hidden and unrecognized lesion. By far a smaller number of chancres occur on the major and minor labia in women than upon the external genitalia in men. The majority of initial lesions as they are found in women occur on the external genitalia, or just within the vestibule. The vaginal wall itself is extremely rarely the initial site of the infection.

For various reasons one would suppose that chancres of the cervix uteri would be quite common, the infection being usually situated at or near the distal portion of the male organ, one would naturally assume that infection of the cervix during coitus would be a not infrequent occurrence. This supposition, however, is not borne out by actual facts, since cervical chancres are really rare, at least so one must judge by the very scant literature covering this subject.

The texts on gynecology throw very little light on cervical syphilitic ulcers, and the question of differential diagnosis between this

condition and other cervical pathological entities is not mentioned.

Fournier reports 13 of 249 cases in which the cervix was found to be the site of the primary lesion, a percentage of five. Rosemuff during six years of experience found only one per cent of his cases in which the cervix was the site.

During the past eight years one of us has seen no less than six definite cervical chancres, and during the past two years we have been able to study two examples of this condition at the University Hospital. Neither of these cases resembled the other in the slightest degree. The extremely interesting clinical findings and the paucity of the literature on this subject seemed to us adequate reasons for publishing our observations, the case histories of which are as follows.

CASE 1. The patient, 37 years of age, was admitted to the University Hospital, complaining of vaginal discharge. The family history was negative. Patient was the mother of four children, ranging in age from eleven to eighteen years and said to be well. She had had three miscarriages, the first coming after the first child, at the seventh month

of pregnancy, and each of the other two occurring during the third month of pregnancy. The patient was unable to offer any reason for any of the miscarriages. Six years previous to her admission she contracted gonorrhea from her husband, who admitted extramarital exposure. In 1910, or two years later, she again contracted a disease which she says resulted in a chronic discharge, in 1912 she separated from her husband and since that time has been extramaritally exposed to infection on several occasions.

Present history: One month previous to entry, following extramarital exposure, the patient noted that after her regular menstrual period there was a marked increase in the chronic vaginal discharge from which she had been suffering for so long. This discharge is described as a foul smelling watery fluid, often becoming sanguineous at night. The patient herself felt that the cervix was enlarged, although it was not tender on palpation. The swelling, however, became so marked that she suffered considerable pain when in the sitting posture, and it was this symptom which led her to consult a physician. The discharge increased in amount, and became yellowish in color. During the past few weeks there has been some loss in weight together with a considerable and increasing weakness. The hair has been falling out rather rapidly and the throat became sore and the voice hoarse. Within a few days previous to her admission the patient had noted small lumps behind her ears and an eruption over her body.

Examination of the patient revealed the following findings. A maculopapular typical secondary syphiloderm over the trunk and upper extremities. Mucous membranes of the mouth and of the pharynx clean. Vaginal examination revealed a markedly edematous cervix the left side being especially enlarged. To the palpating finger the cervix felt considerably more indurated on the left side. Over the edematous portion as well as over the upper right side of the cervix there was an extensive superficial erosion. The eroded surface was decidedly hamorrhagic in character. The remainder of the mucous membrane covering the os was intact, and except for a purplish color quite normal. The axillary and submammary lymph glands were only slightly palpable, those of the cervical and inguinal region were markedly enlarged. The spleen was not palpable. Examination of the blood and urine revealed nothing unusual.

Case 2 The patient a girl of 18 years, entered the hospital with a complaint of severe nocturnal headaches for the two weeks prior to entry. She had no knowledge of syphilis but came to the hospital because she thought that her paramour had the disease. In her family history there was nothing of importance, the present history likewise was negative.

On examination, the patient was seen to be a well nourished young woman. The pupils were equal, and reacted to light and accommodation.

The skin of the entire body was clean. The mucous membranes of the mouth and pharynx were normal. The external genitalia were normal. About the anus were numerous macules suggesting the beginning of large moist papules, although there was no infiltration of these lesions. On vaginal examination, the left side of the lower lip of the cervix was found to be the site of a small dark red erosion about one centimeter in its widest diameter. This erosion was sharply demarcated from the remaining portion of the os uteri, there was a very slight discharge of a thin serous material. Examination of the glandular system showed a marked general adenopathy. The Wassermann reaction was positive.

Following treatment and after the second injection of salvarsan the lesion was practically involuted, only a slight bulging and reddening of the posterior lip remaining.

In both of these cases living spirochæte were demonstrated with a dark field, in smears from the suspected lesion.

The standard texts on gynecology state almost without exception that chancre of the os uteri is a very rare condition. There occur especially frequently in women many cases of frank secondary syphilis in which neither the usual examination nor the anamnesis reveal the presence of the primary sore. In many such cases the chancre, perhaps of the external genitalia, has undergone involution before the patient is examined. It cannot be disputed, moreover, that the discovery of the chancre in women is frequently overlooked, and it may be safely assumed that this apparent rarity is largely due to the failure of complete examination, and to inability to recognize the condition when present.

As has been mentioned before, the statistics of various authors who have written on this subject, while showing considerable variation, nevertheless all support the idea that chancre of the os uteri occurs with relative frequency. Fournier found the primary sore in this location in five per cent of his cases in which a chancre could be demonstrated. Our own experience in a series of fifty cases of fresh syphilis in women gives a proportion of four per cent.

In general the chancre of the cervix differs from that in other parts of the body only in so far as it is modified by anatomical or physiological characteristics of the cervix. As in other chancres, it is indurated, painless,

usually single, being an eroded papule or nodule, and accompanied by a satellite bubo. These characteristics, however, are not as easy to determine as they are in a primary sore of the external genitalia. The difficulty of recognition is all the more apparent when one considers how often the chancre may be atypical. With regard to the induration, which is so essential a feature in the diagnosis of the chancre, difficulty is at once apparent when one considers that the cervix is normally firm, and to the palpating finger somewhat indurated. In the majority of cases, moreover, one is unable to introduce the hand far enough into the vagina to palpate satisfactorily a suspicious lesion on the cervix.

The oedema and general hypertrophy which so frequently accompany the cervical chancre make the demonstration of induration the more difficult, as does also increase in size due to metritis.

The satellite bubo, so valuable an aid to the diagnosis of chancre elsewhere is seldom demonstrable in cases of cervical chancre. The cervix is drained by the perimetrial, hypogastric, and iliac glands, and it is probable that an adenopathy occurs in these chains, but this is not clinically demonstrable. The occasional swelling of the inguinal glands in cervical chancre is explainable probably on the anastomosis between the lymphatics draining the glands of the uterus and vagina.

In the majority of cases no functional disturbance results from the presence of chancre of the cervix, the lesion is entirely painless, both spontaneously and to the touch, and the patient usually has no hint of its existence. That this latter is not always true, however is borne out by our first case in which swelling of the cervix was so marked that the patient was able herself to state where her trouble lay.

It is well known that the chancre wherever seen is subject to great variation in its morphology. The cervix presents no exception to this rule. The chancre may present itself as a simple erosion on the one hand, or as a hypertrophic fungating vegetation on the other, and there may be types varying between these two. In the cases described above, one chancre presented itself as a simple erosion, the other as a fungating lesion so

closely simulating cervical carcinoma that this diagnosis was suggested by a number of colleagues who saw the case with us.

Analyzing the cases in the literature, it would seem that the chancre commonly occurs as a flat, purplish erosion, somewhat sharply raised above the surrounding tissue, not infrequently covered by a pseudomembranous exudate. The lower lip is more commonly involved than the upper, and as in chancre of the rectum the lesion may be linear, and extend up into the cervical canal. The purpuric or hæmorrhagic border so characteristic of the chancre is usually demonstrable in cervical lesions. The essential papular nature of the chancre elsewhere, however, is not apparent on the cervix. The demarcation from the surrounding tissue, however, may not be a sharp one, the borders either fading gradually into it or being on the same level. Rapid development, together with spontaneous involution, may be said to be rather more striking in cervical chancre than in initial sclerosis elsewhere. Occasionally a very superficial red erosion may persist for some time in untreated cases. The discharge from the lesion seems to be dependent upon their size, the simple erosions being attended by slight discharge, the larger hypertrophic types being often attended by considerable seropurulent exudate.

The differential diagnosis includes the consideration of the following conditions: simple cervical erosions, chancroid, Herpes simplex, and carcinoma.

Depending upon the type of the primary lesion present, simple erosion and carcinoma are the most difficult to differentiate. The ordinary clinical differences between Herpes and chancroid on the one hand and chancre on the other, apply with the same exactness and directness to chancres when they occur on the cervix, as when they occur elsewhere and no great difficulty is encountered in differentiating these two conditions.

The definite clinical picture of cervical erosion with its catarrhal discharge, the associated swelling, reddening of the cervix, and severe uterine pain constitute valuable differential points between simple erosions and chancrous lesions.

The objective picture of the lesion itself in simple erosion presents many points of difference from that of the chancre, thus the erosion is usually granular, showing a very irregular ulceration and is very apt to be follicular; and, lastly, of great importance is the chronicity of the erosion, as against the relatively acute course of the chancre.

From carcinoma, the differential diagnosis of the hypertrophic form of the chancre is apt to be more confusing. In the second case described by us the presence of hæmorrhage, the marked friability, and the vegetative character of the lesion led our gynecologic colleagues to advance the diagnosis of early cervical cancer. Indeed, the diagnosis is

extremely difficult in such cases. The spontaneous healing of the chancre, with its rapid onset, and the microscopical examination, may be the only points of clear differentiation. To this we should like to add the differential point which assisted us in our case: namely, the demonstration in the lesion of living spirochetæ. In conclusion, we believe that more frequent examination of women in the early secondary period of syphilis, in whom the chancre is not present on the external genitalia, would reveal a far greater number of cervical lesions than the scanty literature would seem to indicate. Admitting the condition to be uncommon, we feel that it is often missed by not being sought.

PHYSIOLOGICALLY ACTIVE SUBSTANCES CONTAINED IN THE PLACENTA AND IN THE CORPUS LUTEUM

PRELIMINARY REPORT¹

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From Columbia University George Crocker Special Research Fund F. C. Wood, Director

THAT the ovary and the corpus luteum are glands of internal secretion is a statement which requires no discussion, but it has not as yet been fully determined that the placenta may also be classed as belonging to the same group. Although all the earlier injection experiments with ovarian substance and corpus luteum extracts were unsatisfactory in demonstrating *absolute identity between the action of the substances as administered and the supposed physiological and anatomical effects of the substances as secreted by the undisturbed organ*—a fact which was demonstrated by one of us (1) some time ago—in the last few years a distinct advance has been made in the study of experimental ovo and lutein action. The work of Fraenkel (2), Villemin (3), Drevet (4), and others, with corpus luteum and ovarian extracts, and the experiments of Starling (5) with placental and foetal extracts, have not been convincing (6), but the more recent reports by Iscovesco (7), Aschner (8), Scitz, Wintz, and Fingerhut (9),

and, finally, Herrmann (10), show distinct progress, due apparently to a new method of preparing the extracts. While on first examination it would appear that success had been attained because these authors extracted the lipoid or fatty content of the organs and used the lipoid for injection, it is probable that further study will show that the results are due not so much to the use of the lipoid as to the enormous concentration of the active substance, whatever this may eventually prove to be. Formerly aqueous or saline extracts of ovary, corpus luteum, or placenta were employed, and in these the active substance, which is insoluble in water, was present only in minute quantities, while today extracts are made with alcohol, ether, or other fat solvents so that the active substance, which apparently either is a lipoid or is carried along by the lipoid of the organ, is greatly concentrated, and, therefore, should evidence its physiological effects to a much greater degree. This is actually the case. Some investigators believe that the potent

substance is a lipid; others think that it is a protein in conjunction with a lipid; and still others, as Herrmann, claim that it is simply carried along by the lipoids, and that after the lipoids have been removed the remainder contains the active substance. Whatever the nature of the substance may be, however, there is no doubt that positive results have been obtained by various experimenters in the last two years, although none of them agree exactly as to the nature of the substance employed or as to the method of preparation.

For a year we have been testing the biological action of extracts of placenta and corpus luteum. The first experiments were made with an extract containing all of the alcohol- and ether soluble substances, in a second series the extract used was composed of two fractions: one containing the substances extracted with acetone, the other the substances insoluble in acetone, while in a third series, the fractionation was carried to a further degree — alcohol ether, acetone, and chloroform soluble substances being separated.

As this is a preliminary communication and the work has not yet been completed it will suffice for the present to give a general description of the experiments without extensive details as to the quantities employed, the methods used etc. merely indicating the results in a broad and general way.

Methods. The extracts were emulsified either in normal salt solution or in a combination of normal salt solution and olive oil, the object being to obtain a smooth and permanent emulsion.

Animals. In order to obtain an approximately constant physiological object for experimentation the following method was employed. Rabbits of about the same age and weight were selected and on these double lumbar oophorectomy was performed, a portion of the left uterine horn being removed at the time and kept for additional control. As is well known the uteri of castrated rabbits of the same age and weight attain an approximately stable condition of atrophy in the course of four or five days, the atrophy remaining at about the same degree for two to three weeks. For the sake of convenience and brevity, this neuter and stable condition of the



Fig. 1. Uteri of rabbits injected with placental extracts. The short piece of uterus seen to the left of each figure is a segment of the left horn removed at the time of oophorectomy. Uterus 171 was from a rabbit injected with acetone soluble placental extract with positive effect, uterus 170 from an animal injected with acetone insoluble extract without effect.

uterus will be designated the "castrate norm." In every instance the "castrate norm" showed distinct involutary changes compared with the portion of the uterus removed at the time of oophorectomy. The castrated animals were injected with the extracts to be tested, and after a period varying from fourteen to twenty-eight days they were killed and their uteri examined. For comparison there were at hand the horn removed at the time of castration, the "castrate norm" for rabbits of a given weight, and finally, the uterus as found at the time of death. The macroscopic appearance of these uteri was noted and cross sections at various levels were made for microscopic examination.

Methods of exhibition of the extracts. In almost all of the experiments rabbits were in-

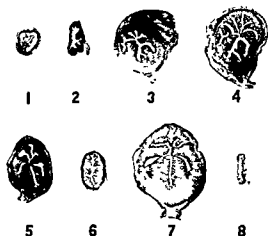


Fig 2 Cross sections of rabbit uteri (low power) 1, Unoperated control, 2, castrate control, five days after operation (castrate norm), 3, castrate after fourteen injections of placental extract, 4, castrate after fifteen injections of boiled placental extract, 5 castrate after 24 injections of corpus luteum extract, 6, horn removed at time of castration (Fig 1 uterus 171), 7, uterus of same animal (castrate) after fourteen injections of acetone-soluble placental extract (Fig 1 Uterus 171), 8, uterus of castrate after fourteen injections of acetone insoluble placental extract (Fig 1, uterus 170)

jected subcutaneously with the emulsions used, the site of injection being as far as possible from the abdominal breasts in order that local reaction might be avoided, and after each injection the area was massaged so as to increase the rapidity of absorption. As a rule, injections were made daily. In most instances the animals lost weight rapidly but they rarely died as a result of the injections. In a few experiments the drugs were given by mouth through a stomach tube.

Effect of placental extracts. Animals injected for fourteen successive days with extracts of placenta showed an enormous hypertrophy of the uterus, the organ having increased in thickness, in length, and in weight. Its surface was distinctly congested, and on the whole it resembled a uterus one to two hours post-partum. This condition was seen in rabbits weighing as little as 450 grams, that is, in animals which had not reached the age of puberty. On cross section the uterus showed an enormous increase in all layers, the musculature and



Fig 3 Cross sections of rabbit uteri (low power) 1 Horn removed at time of operation, 2, castrate after feeding alcohol soluble placental extract by mouth for eleven days, 3 and 4, before and after injections of alcohol soluble placental extract (11 injections), 5 and 6, same as 3 and 4, using smaller doses of extract

mucosa being equally hypertrophied. The epithelium and glandular structures of the mucosa showed distinct activity, although mitoses were extremely rare. Some desquamation of the epithelium was noted at times. The extracts containing all the fat soluble substances were found to be by far the most potent. The fraction containing these substances, the alcohol, ether, acetone, and chloroform extracts, gave an active physiological effect, but this was distinctly less, quantitatively, than that of the entire, unfractionated placental extract, while the fractions not soluble in lipid solvents proved to be completely inert.

Effect of corpus luteum extracts. The results of injections with extracts of corpus luteum were less striking and, as will shortly appear at first proved to be very confusing. The first experiments were made with the unfractionated corpus luteum extract. This proved to be almost as potent as the placental extract, only slight differences, if any, being apparent both macroscopically and microscopically. The hypertrophy was nearly as marked as that seen after injections of placental extract, but appeared only after twenty to twenty-eight injections had been given.

Congestion of the surface of the uterus was never, (very marked Microscopically, all layers showed hypertrophy; the mucosa seeming to be thicker than that seen after placental extract injections. Desquamation was rarely noted, and mitoses were no more frequent than after the use of placental extract. Succeding fractions, however, proved to be entirely inert, although alcohol, acetone, and chloroform were used in the fractionation. Upon inquiry it was found that Armour and Company, to whose kindness we were indebted for the large quantities of fresh corpus luteum substance used for extraction, had "degreated" two batches because it had been thought that this would make the substance more stable. Naturally in the process of degreasing with either alcohol or ether, the lipid substances were removed, and the mass received by us proved to be inert. The unfractionated extracts of a further batch of non degreased corpus luteum substance however, proved to be equally inert. In the last instance the substance was derived from non pregnant animals, while the first corpus luteum substance extracted, and the only one found to be active was derived from pregnant animals.

Summary of results From the foregoing it is apparent that the claims made by certain investigators (*loc. cit* 7 to 10) can be, at least partially corroborated. By means of concentration, active corpus luteum and placental substances are obtainable. If not identical, the substances contained in the two glands, the placenta and the ovary are at least very similar in action. As no chemical entity has been isolated, no quantitative comparison between the efficacy of placental and of

corpus luteum active substances can be made. The effect upon the mammary gland of placenta and corpus luteum extracts in the concentration used is apparently slight, but whether this will apply in an equal degree to a more concentrated extract is yet to be determined. Extracts of the corpus luteum substance of pregnant animals appear to be more effective than those of non-pregnant animals. The fact that unfractionated placental and corpus luteum extracts were quantitatively more efficacious than any of the fractions obtained, makes it appear probable that the active substance is not a lipid but is carried along the lipoids. At present, the employment of these unpurified extracts clinically is entirely out of the question, because the toxicity of the mass of lipoids is considerable, as was shown by the emaciation of the animals. Furthermore, when the extracts are given by mouth a distinctly poisonous effect was sometimes observed, but whether this was due to autolytic products of decomposition (cholesterol?) or to anaphylactic phenomena was not determined.

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DEPARTMENT OF TECHNIQUE

OPERATIVE TREATMENT OF BAD RESULTS AFTER FRACTURE¹

By JAMES E. MOORE, M.D., MINNEAPOLIS, MINNESOTA

THE subject of operative treatment of bad results after fracture is chosen because every practitioner treats fractures, and we all get some results that are far from satisfactory. It has always been an interesting subject, but its interest has been greatly increased since the advent of the skiagraph, for it not only aids us in diagnosis and treatment, but it makes our mistakes more apparent. A result that is satisfactory from a practical standpoint may show marked displacement and deformity in a skiagraph. Advantage has too often been taken of this fact by those who are anxious to bring suit for malpractice.

The two great misfortunes that may follow a fracture are first, non union, and second, deformity accompanied by disability.

Our ideas concerning the causes of non union have been materially changed within the past

few years. We have learned that syphilis is not so frequent a cause as we formerly believed. Dr. Abbot, of St. Paul, recently reported a series of severe fractures among a group of miners, most of whom were suffering from syphilis and there were no cases of non union. Age was formerly believed to be a frequent cause of non union, but the fact is that most cases of non union occur in persons in middle life, youth and age being comparatively exempt. This mistake was doubtless due to the fact that fracture of the neck of the femur, which occurs most frequently in the aged, was so commonly followed by non union. Within a few years, however, we have learned that the reason for non union in these cases was that the fragments were not brought in apposition by our former methods of treatment, and that when the fragments are brought in apposition by modern methods of treatment they unite in the majority of cases. We have also learned that, contrary to our former belief,



Fig. 1 Skiagraph of impacted fracture of the neck of the femur



Fig. 2 Graft placed in medullary cavity

¹ Read before the North Dakota Medical Society, Bismarck, North Dakota, May 11, 1915.



Fig 3 Skiagraph shows replaced trochanter in patient operated upon after using crutches two years

fracture of the neck of the femur is quite common in youth and childhood. Non-union in these young people is practically unheard of, because the fracture is usually of the "green



Fig 4 Pott's fracture

Fig 5 Pott's fracture

stick" variety and the fragments are not separated.

Many of the cases of coxa vara are really cases of unrecognized fracture of the neck of the femur which have united in a faulty manner for lack of proper treatment. Figure 1 was taken of a lad of fourteen years who came to the University Hospital in March, 1913. In September, 1912, while plowing, the horse stumbled and the plow "kicked" him on the right trochanter. Although he felt some soreness and disability he continued to work until January, 1913, when he fell on the ice. He walked on the limb that day, but by evening he was unable to move the joint and experienced pain when he walked. He was obliged to use crutches up to March, when he entered the hospital. Upon admission he could not walk without pain, his hip was quite



Fig 6

Fig 6 Pott's fracture



Fig 7

Fig 7 Showing astragalus directly under the tibia so that the body weight falls upon it without causing eversion



Fig 8 (above) Ulna broken into fragments and the head of the humerus dislocated forward

Fig 9 Resulting deformity from fracture shown in Fig 8

Fig 10 Result of sewing neighboring fascia over bony surface to prevent union between radius and ulna

stuff, there was three fourths of an inch shortening, marked eversion, and the skiagraph showed an impacted fracture of the neck of the femur. There was bony union at this time, and he was sent home without treatment.

Doubtless many cases of non union have been due to the presence of muscle and other tissues between the fragments. In other words, the fracture had not been properly reduced. At the present time, by the use of the X-ray, we can learn to a certainty when the fragments do not come in contact, and when they cannot be brought in proper relation by manipulation we adjust them through an open wound. There is, therefore, no longer excuse for non-union due to improper adjustments of the fragments.

There remains, unfortunately, a large number of cases of non-union for which the surgeon is in



Fig 11 (left) (Velma Horn) Lateral oblique fracture before repair six days after injury

Fig 12 Same case as Fig 11 Two weeks after operation Flexion from primary position 20°

Fig 13 Same case as Figs 11 and 12 Three weeks after operation Arm in voluntary extension

no way responsible, and for which until very recently he has been able to do very little. These cases occur in persons who, for reasons that we do not understand, have not the power of producing osteoblasts, and no matter how well the fragments may be adjusted non-union will follow. The patient may be, and usually is, a healthy individual, for fractures usually occur in healthy people, he may not be suffering from syphilis or any constitutional disease, and may not be addicted to the use of alcohol, and yet be unable to produce new bone cells. It is in this class of cases that we have so often failed to secure bony union by operation. It is utterly useless to apply a Lane's plate, for that hinders rather than promotes the production of osteoblasts. Wiring is equally inefficient. Fortunately we are now able to secure bony union in a large percentage of these cases by the use of the bone graft. The graft is believed by some surgeons to have osteogenetic properties of its own, because instances are on record in which the bone graft has been broken and afterward united. The writer does not understand how a strip of bone taken from one part of a patient's body can be expected to have osteogenetic properties when he has failed to produce osteoblasts in another. The presence of the graft undoubtedly stimulates osteogenesis in the original bone. We have been very successful in this work in the University Hospital. Through defects in our technique we have sometimes failed to secure results by our first operation, but have ultimately secured them in all but one instance, and that patient has recently been reoperated upon. We have learned that grafts from the patient's own person are the best, and that grafts covered by periosteum act more

quickly. While the part played by the periosteum has been greatly overestimated in the past, there is no doubt in our minds but that the presence of periosteum on the graft aids osteogenesis. Whether the periosteum has real osteogenetic properties is still a disputed question.

There are three accepted methods of bone grafting: First, that of Buchanan, in which a piece of bone is removed from each of the two fragments, one long and the other short. The fragments are then transposed so that the long graft bridges over the seat of fracture. This is the method the writer has employed in most of his work. It is eminently satisfactory, and it can be done with the mallet and chisel better than can either of the other methods. The grafts can be held in place by chromic catgut passed around the bone and tied over the graft, or by drilling a small hole transversely through each fragment through which is passed a strand of kangaroo tendon which is tied over the grafts. This is Albee's suggestion.

The second method, suggested by Murphy, consists in reaming out the medullary cavity in each fragment and introducing the graft into these openings so that it extends beyond the area of eburnated bone in both fragments. Figure 2 shows a case in which the first graft was placed in the medullary cavity and resulted in failure because it did not extend beyond the eburnated bone in one of the fragments. A second transplant was applied by the method to be described later, and union is taking place but for lack of time is not yet complete. The remains of the original graft can be seen. The objections to this method are that the transplant must be comparatively small and is liable to be broken when the patient moves his limb, and it is quite difficult to so adjust the transplant that it extends well beyond the eburnated bone in both fragments, and this is absolutely necessary because the eburnated bone has very little if any osteogenetic properties.

This third method of applying the bone graft is the favorite method with most surgeons but requires the electric saw to perform it properly. It is performed by properly adjusting the two fragments, after which the periosteum is incised and turned back so that it can be stitched over the graft after it has been placed in the groove. Then by means of an electric bone saw with two parallel blades two grooves are cut in each fragment. These grooves should extend into the medulla and beyond the hardened bone in each fragment. The bone between the grooves is then severed at either end by a chisel and re-

moved, leaving a deep, smooth sided gutter. A strip of bone is then removed from the patient's tibia with the same saw with the same adjustment, and placed in the gutter made in the fragments. Made in this manner the graft fits accurately, and can be held in place by closing the soft parts snugly over it, or by Albee's method without the necessity of introducing any unabsorbable material. The wound is then closed without drainage, and a plaster-of-Paris splint applied over the surgical dressings. Whenever practical it is very desirable to extend the plaster splint beyond the two neighboring joints so as to prevent motion and strain upon the graft.

Operations for the relief of deformity and disability are very difficult and no two of them are alike. While the results are often disappointing, they are frequently very gratifying to both patient and surgeon. When we undertake these operations we should make no promises of perfect results, for they are not to be expected, and the possibility of failure should be clearly stated. These patients are often willing and sometimes anxious to take the chances of improvement when the surgeon promises to do his best and offers hope of improvement. The principal care of the surgeon should be that he does no harm.

It is impossible to cover this whole subject in one paper, so I have selected a few cases to illustrate the possibilities of this work.

We all meet with patients suffering from disability following fracture of the neck of the femur. The condition is almost invariably non-union from lack of proper adjustment of the fragments. A certain number of these patients can be secured a good useful limb by operation. The patient must not be too old, and must be in good health, because the operation is a severe one and the patient will be confined to his bed for a number of weeks. It must be remembered that it is only the select few of these patients that can be operated upon with any hope of success.

Figure 3 was taken of a patient upon whom I operated after he had been obliged to use crutches for two years, and the result was a good useful limb and the abandonment of the crutches. The joint was reached by a large U-shaped incision with its base above the trochanter and its apex downward, extending through the fascia lata to the muscles. This flap was turned up and the great trochanter saved off and turned up permitting access to the joint from the front. The broken surfaces were then freshened and the fragments fastened together by two steel nails. The third nail seen in the skiagraph was driven through the replaced trochanter to hold it in place.

Pott's fracture is a very common cause of deformity and disability which, fortunately, lends itself admirably to operative treatment. The two following photos (Figs. 4 and 5) were taken of a patient upon whom I operated

many years ago. As you see, he had sustained a Pott's fracture which had left him with a deformed foot, so disabling him that he was unable to follow his trade as a plumber. An osteotomy was performed upon the tibia and fibula, the foot forced into a position of overcorrection and held there by a plaster splint. The result was that the patient was able to work at his trade very comfortably.

The next two skiagraphs were taken of a patient referred to me by Dr Wallace of St Joseph, Mo. This patient was thrown out of a wagon in a runaway and sustained a complicated Pott's fracture, as shown in Fig. 6. I first saw him about five weeks after the accident. Bony union had taken place, but the foot was so badly everted that the weight of the body transmitted through the tibia fell inside of the astragalus. A wedge-shaped piece of the soft new bone was removed from between the fragments of the tibia through a longitudinal incision and the lower fragment loosened. A longitudinal incision was then made over the site of the fracture in the fibula. The fibula was broken by an osteotome, the lower fragment turned down, and the new bone chiseled out from between the tibia and fibula. The foot was then inverted as far as was possible with the unaided hands of the assistant and myself. The wounds were then closed and a plaster splint applied. The result, as shown by a skiagraph, taken the next day, was not satisfactory, because the astragalus was still too far out to receive the transmitted weight from the tibia properly. The foot remained at such a mechanical disadvantage that the tendency would have been for it to become more and more everted when the patient walked. The patient was anesthetized on the following day the splint and most of the dressing removed and heavy pressure applied over the outer side of the foot and outer malleolus by means of an osteoclast, such as is used by orthopedists for breaking bones. The result was marked improvement, as shown in this skiagraph (Fig. 7). Although the picture shows that the astragalus is not as far in as nature intended it to be, the foot was decidedly inverted. This picture shows the astragalus directly under the tibia so that the body weight can fall upon it without causing eversion. Some of the stitches were broken at the second operation allowing some gaping of both wounds. These were replaced and a plaster splint applied over moderate sized surgical dressings with the foot in an overcorrected position. *It should be noted that no foreign material was introduced to retain the fragments in place.* When sufficient force has been applied to overcorrect the deformity nails or screws are not necessary and they should always be avoided when it is possible. The convalescence was comparatively uneventful, and there was remarkably little pain. On account of the oedematous condition of the tissues at the time of operation and the severe confusion at both operations, primary union was not complete, and a small piece of the fibula became necrotic and was removed but at no time was there a deep infection. The patient left the hospital in three weeks with both wounds nearly healed. I have not seen him since he left the city but in less than two months after the operation he reported to me that he was delighted with the result because he had thrown away his crutches and could walk without a limp or pain. He stated that the motion in the joint was almost normal. The difficulty in correcting the deformity in this case was due to new formed bone and other tissues and it is very evident that a lesser degree of pressure applied shortly after the accident would have secured as good, and possibly a better result. The writer would suggest that the osteoclast be used in recent cases of Pott's fracture applying a sufficient force to place the foot in a position of over correction.

The next case was a patient who came to the University

Hospital because of ankylosis of the elbow joint following a fracture of the condyles occurring nine months previously. The loss of motion was due to the bridge of new bone in front of the joint. This bridge of bone was chiseled away by Dr A. A. Law of our staff, and the neighboring fascia brought over the raw bony surface to prevent a new formation of bone. The immediate result after the operation was very satisfactory, for motion was almost completely restored. The patient returned fourteen months later complaining of increasing loss of motion in the joint. A large growth of bone had formed on the anterior surface of the humerus. Dr Law again operated, removing the projecting bone and covering the raw surface with a piece of periosteum taken from the patient's tibia. The immediate result was quite satisfactory, but it is too soon to know what the final result will be. This case illustrates one of our greatest difficulties in this work. There is a persistent tendency to the reformation of new bone, especially between bones as in the forearm. Our only hope seems to be in the use of periosteum or firm fascia, like the fascia lata, to act as a limiting membrane to keep the osteoblasts within bounds. At the second operation in this last case the new bone was so deeply buried in newly formed connective tissue that it was difficult to reach it, showing that a transplanted fascia with a function to perform has a tendency to grow and develop.

The next three pictures were taken of a lad of fifteen years, a patient of my associate Dr Arthur C. Strachauer, who was injured in an explosion. The first skiagraph (Fig. 8) shows the ulna broken into a number of fragments and the head of the radius dislocated forward. The next picture (Fig. 9) shows the resulting deformity and a firm bony union between the radius and ulna. When first seen six months after the accident, pronation and supination were absent, there was very limited flexion and extension, and he could not reach his nose or mouth. Dr Strachauer operated at the Northwestern Hospital. An incision was made over the head of the radius with the hope of reducing it, but it was found immovably fixed and osteoporotic from disuse, and was excised. An incision was made over the outer side of the ulna, the bone broken with an osteotome, the ends turned out and the bony deposit between the radius and ulna removed with chisel and rongeur. A Lane's plate was then applied to the ulna at the seat of fracture to maintain reduction, and to hold the ulna away from the radius. The neighboring fascia was sewed over the raw bony surface to prevent union between the radius and ulna. The result is shown in the next picture (Fig. 10). Six weeks after the operation the patient had complete flexion and extension, with rotation of from one half to two-thirds of normal, and he could touch the back of his neck, the top of his head and could reach his nose and mouth. On account of the persistent tendency to the reformation of bone between the radius and ulna in these cases this patient will doubtless lose some of his rotation but even then will be in a much better condition than he was before the operation.

The next three skiagraphs were taken of a girl of seven years also Dr Strachauer's patient who was injured by a fall. As you will see (Fig. 11), there was posterior and lateral dislocation of the radius and ulna and fracture of the external condyle of the humerus with wide separation of the fragment. Repeated efforts had been made at reduction but had failed so an incision was made over the posterior aspect of the joint the articular ligament repaired with chromic catgut, and the condyle fastened to the shaft of the humerus with a steel nail and the wound closed in the usual manner. Figure 12 was taken two weeks after the operation, with the arm in voluntary flexion. Figure 13 was taken three weeks after operation,

with the arm in voluntary extension Six weeks after the operation all motions of the elbow and forearm were perfect This will be a permanent result because the operation was performed soon after the accident

The illustrations shown demonstrate how difficult these operations are when delayed, and how much easier they are and how much better the results when the operation is done soon after

the accident, before Nature has undertaken repair with the parts in a faulty position, and make a strong plea for early operation.

In every case of fracture of the elbow, and in every case of Pott's fracture when reduction cannot be accomplished by manipulation, operation should be resorted to before new bone has commenced to form

THE CONSTRUCTION OF AN ARTIFICIAL VAGINA WITH ESTABLISHMENT OF THE MENSTRUAL FUNCTION¹

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IT is not my intention in this short paper to go into a discussion of the propriety of making a patient go through the dangers of a major operation in order to make a vagina for her if she has not a functioning uterus. There is no question but that she can go through life quite comfortably, so far as physical comfort is concerned, without genital organs, but when the psychic aspect is considered it is quite a different proposition, and much can be said on both sides. My own views on the subject are very simple. I believe that the sexual life is very important for the happiness of a very large proportion of mankind, and if a girl finds that part of life is impossible for her she is likely to brood over the loss and imagine it even greater than it is, so, if she, fully understanding the danger of the operation, still wishes to have it performed, I am perfectly willing to try to remedy the defect in her anatomy. So far as the present case is concerned, however, the question did not come up, for a functioning uterus was present, and I think that there is no surgeon but who would say that with blood damming back in the womb each month, operation of some kind is imperative.

The ideal of surgery is to make the body as nearly normal as possible, so instead of removing the uterus and stopping menstruation, if the vagina is absent, I believe a vagina should be made, to form an outlet for the menstrual flow. This procedure will also make the woman fit for marriage if she ever desires to marry.

In the past ten years several operations have been devised for the purpose of making an artificial vagina, and they have all been tried successfully in a few cases. Before that time the plastic operations devised tried to line the canal with

skin flaps from the thighs or vulva or with peritoneum from the cul-de-sac of Douglas, but they were almost all failures, as the flaps would slough and the vagina contract and be worthless.

In 1897 the first advance was made: Gersuny (1) tried to cover the canal with mucous membrane. He cut it from the rectum and was fairly successful in maintaining a canal, though it was necessary to wear a pessary. In 1904 Dr. Baldwin (2) of Columbus devised the first completely successful method, in 1907 (3) he first tried it, and in 1912 (4) he reported that he had had six cases, all successful. He resects a portion of the ileum and draws it down into the pelvis with the mesentery still intact. Several others also have tried this method. Dr. Boldt (5) of New York has had 2 cases, Dr. Stewart (6) of Philadelphia, 1 case, Dr. Kerr (7) of Glasgow, 1 case, Dr. Bonney (8) of London, 1 case, Dr. Phillips (9) of Sheffield, 1 case, and Dr. Wright (10) of Buffalo, 1 case. Of all these cases I have been able to find the original reports, and there are several others, too, which have been alluded to, but which I could not trace. All these cases have been successful.

The Germans prefer to work from below. Dr. Albrecht (11) has had three cases in which he made the vagina from the sigmoid, and Drs. Schubert (12) and Strassman (13) between them have had nine cases. They utilize the rectum and think it a much simpler and less dangerous method. Never having seen or tried their method, I am not qualified to compare it with the Baldwin method which I used in my case.

Miss D. F., schoolgirl, age 13, is still very much a child in her makeup of the long and lanky type, loose-jointed. At times one of the synovial fringes would catch in her

¹ Read before the Medical Society of the County of Monroe, May 18, 1915.

left knee-joint, and would often make her fall. The knee would be swollen and tender for two or three days afterward. She has always been troubled by enuresis, sometimes in the daytime as well as at night. She was a frail child, but had no severe illnesses.

In the fall of 1913 she had three similar and rather peculiar attacks. The attack began with a sharp crampy pain felt across the lower abdomen and also in the epigastrium. This was followed the next day by vomiting at short intervals all through the day, and urination was very painful. The quantity of urine was small. There were four or five loose stools. There was a little tenderness in the hypogastrium but no rigidity at any point. These symptoms lasted for a couple of days and then cleared up and she was apparently entirely well.

But she had had two other attacks just like this, one in November and one in December, and then I began to realize that they were just six weeks apart. The periodicity being established immediately suggested some obstruction to the menstrual function, for up to this time she had never flowed. In January again the pains came on sharper than ever, and I urged a vaginal examination under ether. Between the anus and urethral meatus there was a blind sac not more than three-fourths inch in depth. A rectal examination showed the uterus and ovaries to be present. Diagnosis of congenital absence of vagina was made and operation advised.

She was admitted to the Rochester General Hospital February 13, 1914, and the next day the operation was performed. A careful dissection was made between the bladder and rectum and at a depth of about three inches from the incision of the mucous membrane the cervix was reached. It was grasped with a double tenaculum and pulled down, the connective tissue around it being peeled back, until finally the mouth of the cervix was exposed, a dilator passed into it revealed about an ounce of black, tarry blood in the uterus. This was evacuated, and the cavity of the uterus, which was a little longer than normal, wiped out with gauze. It was then packed with iodoform gauze as was the cavity for the new vagina. It took about an hour to do this much of the work, and as the patient was a frail child, it seemed wise to stop here and not attempt the bowel resection until a second sitting.

On February 19 the second part of the operation was done. The incision was made in the median line. The cecum was located and a loop of small intestine twelve inches long just proximal to it was selected which when doubled will reach well down through the pelvis to the vulva. The loop was isolated by rubber covered clamps and separated from the rest of the intestine, but was left attached to its own mesentery. The distal end of the isolated loop was closed by a purse string suture of silk, and half of a Murphy button was dropped into the short end of the ileum attached to the cecum; the other end of the loop was cleansed but not closed and the other half of the Murphy button was introduced into the proximal end of the ileum. The isolated loop was now freed by making radiating incisions into the mesentery at each end to a depth of about three inches which allowed the loop to be pulled into the pelvis without cutting off its blood supply. Putting together the two halves of the Murphy button restored the continuity of the small intestine, and the cut edges of mesentery were sutured together closing the gap in the mesentery and covering over the raw edges. Then I opened the peritoneum into the cavity which I had made at the first operation and with a forceps drew the doubled loop of intestine down to the vulva stitching the open end around the cervix. Placing these sutures was the most difficult part of the whole operation as the anterior lip of the cervix was almost impossible to reach

from above. I now believe I could have placed these sutures more easily from below. This finished the abdominal work. I closed the abdominal incision rapidly with through and through silkworm gut sutures, then opened the loop of intestine at the vulva and stitched the edges there, packing both limbs of the intestinal loop with iodoform gauze. Great care had been taken to avoid all roughness in handling the intestines, but the amount of work done required two hours of time. She left the table with a pulse of 180 and very weak. As she came out from the ether her condition was desperate, pulse 200, hardly palpable even in the neck, color very bad. She was given saline and strong stimulation, and fortunately she had just enough vitality to carry her over the period of shock. By midnight her pulse had dropped to 150 and by the next morning it was 126. Her convalescence was uneventful and she went home before the end of the third week, and in another two weeks was getting up and around.

The loop of bowel did not slough at all, but has become fixed in its new position; and now, over a year afterward, she has a perfectly good vagina, though a double one, as I have not yet crushed the septum between the two loops.

I have had some difficulty in maintaining the connection between the uterus and the new vagina. At the time of the operation I found it very difficult to suture the end of the intestine to the cervix, and later it slipped away, leaving the cervix just above the new vagina. So I had to cut through the wall again at this point into the cervix and again suture the mucous membrane around it, I then introduced a silver stem pessary such as Carsten uses for dysmenorrhoea. Now the girl is menstruating naturally and painlessly.

The case has been a very interesting one to me. The operation was performed almost exactly as Dr Baldwin described it, but it differs in one particular from the cases he has done. In all his cases, and in all those I have been able to follow of other operators, the uterus has been either absent or diseased, so they have simply built a vagina without connecting it to a uterus. This I believe is the first case on record in which a vagina has been successfully made and connected with a functioning uterus so that the regular menstrual function has been established.

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THE MANAGEMENT OF DEFICIENT LACTATION¹

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ALL will agree that the ideal food for the infant is mother's milk and that an insufficiency in supply is a common occurrence. When breasts are deficient, or the child, because of an anatomical deformity, cannot nurse, the reason for a failure in lactation is apparent. We find, however, even when anatomical conditions are perfect that the child frequently fails to gain in weight, and eventually under ordinary conditions of practice, the child has to be raised on the bottle.

The failure of the breasts to engorge on the second to the fourth day is so rare an occurrence that it can be said that the breast reaction always occurs. This reaction signifies the appearance of milk. Unless the child nurses or the milk is withdrawn otherwise, the breasts gradually dry up, and milk is no longer secreted.

Usually the nursing reflex is strongly developed at the time of birth, but frequently we find that large, normal-appearing, full term babies, make no effort whatever to nurse, and, if they do attempt to nurse, the effort is short in duration and they promptly fall asleep. These infants continue to lose in weight, and usually excite no particular attention until they get into a dangerous condition. Every effort must be made to keep such a child awake while at the breast. Cold applications to the feet, or other forceful irritation, must be employed. If the infant does not nurse, the breast must be pumped or else lactation fails. If insufficient breast milk is obtained to nourish the child, artificial food must be supplemented. As soon as the babe secures sufficient food, it usually awakes from its lethargy and begins to nurse normally. Early attention must be paid as to how well the newborn nurses, so that requisite means of relief may be given in time to prevent failure of lactation. An indolent infant must be given plenty of water to drink, and much stress must be laid upon this rule in nurseries where water is generally used as a pacifier and where such an infant is left undisturbed because it so rarely cries. A deficiency in water is usually responsible for large losses in weight during the first three or four days.

When a normal baby does not begin to gain in weight after the mother's milk reaction has occurred, a prompt investigation of the cause must be instituted. The child is weighed before and after each feeding to ascertain the amount

of milk obtained. An average of three ounces to a nursing is requisite for a daily gain if the child is of normal size and is nursing six times daily. After the child is removed from the breast, the breast is pumped or milked manually to see if residual milk is present. It should be noted also whether the milk escapes readily in several streams or whether it issues slowly and through but one or two ducts. There is just as great a variance in mothers in this respect as is met in the animal world. If milk gushes from the breast after the child has obtained an insufficient amount, the child is apathetic. The breasts may feel still fairly full and the pump show that the milk escapes slowly and in but one or two very thin streams. The milk may come with such difficulty through an insufficient number of ducts, that the newborn babe becomes exhausted before it can obtain a sufficient amount. Later, however, with increased strength it may empty the breasts in a very few minutes. In all cases where residual milk is left, the breasts should be thoroughly emptied or milk secretion will fail. This fact should be as well appreciated by the obstetrician as it is by the dairyman.

No breast pump is so efficient as a strong child that knows how to nurse. In the light of our present knowledge regarding syphilis, however, no strange child should be applied to a woman's breast unless both mother and child have negative Wassermann reactions. The variations and failures of this test to detect syphilis, however, make it imperative that this means of stimulation be employed only in extreme instances.

When the fault is with the breast, when we are dealing with an absolute deficiency of milk, the most efficient galactagogue is stimulation of the breast by withdrawal of the milk present. The demands on the breast as a means of increasing supply is seen during the course of every lactation. The newborn will empty the mother's breast when it has taken three to four ounces while months later the same breast may yield ten ounces at a nursing.

When we have demonstrated that the case at hand is one of deficient lactation, it is necessary to take into consideration a great number of details when trying to rectify the condition.

The mechanism of lactation is a very delicately balanced affair during the first weeks and is very easily influenced adversely. The effect of emo-

¹ Read before the Chicago Gynecological Society (for discussion see p. 664).

tions upon secretions in general is very well established and is well known. Nowhere is this effect more marked than upon lactation. A fright has more than once been noticed to be followed by a decrease or absence of milk. An irritating nurse or husband or a bickering mother-in-law may have such an emotional effect upon a new mother as to seriously interfere with her milk production. Painful impressions and sleeplessness and all things which interfere with the psychic rest of the patient may decrease the secretion of milk. Unhappiness and discontent may have their bad effect. These factors are only transitory in action if removed early, but if long-continued the deficiency in secretion may be permanent. A change of surroundings may work wonders toward building up a plentiful supply of milk. A change of nurses may be a necessary treatment. In a resistant case sending the patient home from the hospital is frequently followed by an abundant milk production. So that a psychological study of the patient and her family often has to be instituted in order to obtain results in this field.

The physical condition also has to be taken into consideration. A patient who has had a severe hemorrhage often has a late milk reaction and a deficient milk supply. A continuous drain through profuse lochia in the puerperium may have a similar effect. In this regard however, it must be remembered that ergot may impair lactation.

The patient's general condition must be improved in every way. An abundance of nourishing food is very helpful, but cramming may be harmful if it results in indigestion. No particular food or medicine has a specific action as a galactagogue. In a former paper¹ I showed that the claims for pituitary extract were based upon faulty experimental work. Occasionally, an individual may have an idiosyncrasy for some particular food. One patient was extremely annoyed by painful engorgement and marked leaking of the breasts each time she ate fresh pork. Another had a similar experience each time she ate ocean fish, neither had such reactions at any other time. None other of my patients has noticed peculiarities toward certain foods and I have questioned many of them. A mixed diet is advised and no particular stress is placed upon milk-making quantities, for such special peculiarities do not exist. The belief that the constituents of the milk can be influenced by food is held only by those not acquainted with the feeding experiments in dairy herds. An individual woman has

milk of a certain quality and this approximate quality will be maintained under all conditions of food taking. A milk analysis is of no worth whatever in the management of breast nursing.

The attention given to the act of nursing itself is of the utmost importance when wishing to restore lactation to its proper level. The child is put to the breast and allowed to nurse for not longer than 15 to 20 minutes. If the amount taken is not 3 ounces, when the child nurses six times daily, the deficiency is supplied with pumped milk or artificial food.

If no great variation is met in the amount nursed at the several times, an average is struck and a fixed amount of supplementary food is given each time. If one breast is small and a marked difference in secretion is determined, the child may be put a while on the good side after each nursing on the defective side. In many cases, a sufficient amount may be obtained if both breasts are given at each nursing. If the supply of breast milk is to be increased, care must be taken not to give too much supplementary feeding, since if the child gets too much from the bottle, it will not nurse the breast properly at the next nursing and the breast milk will disappear rapidly because of insufficient stimulation, also the substitution of a bottle for a breast feeding should be prohibited in early cases of deficient lactation because the periods between breast stimulation are too long and the breast always fails. The feedings must be weighed from day to day since the amount of breast secretion may be very variable. As the quantity of breast milk is increased, the supplementary feeding is reduced. If the child shows an average increase of more than one ounce daily, even though the weighing of the feedings may not demonstrate an increase in lactation, the supplementary feedings are reduced so that the increase in body weight does not exceed this amount.

It may be said that the usual baby scales or kitchen spring scales are entirely useless in the accurate management of such a case. An accurate beam scales weighing at least to $\frac{1}{4}$ ounce is indispensable.

When the child has nursed, the breast is pumped or milked manually to empty it. In no case is pumping allowed for longer than 10 or 15 minutes, because the breast is practically empty after this effort, and prolonged efforts make the patient tired and nervous.

Of chief importance in the stimulation of lactation, I have found passive hyperemia of the breasts by means of a Bier pump. During my services in the Frauenklinik in Heidelberg and

¹ Surg. Gynec. & Obst. 1913, 23:1-103.

Vienna, I became interested in Jäschke's work along this line, and during the six years since, I have had abundant opportunity to demonstrate the efficiency of this method of treatment.

A sufficiently large bell is selected so that it allows plenty of room for complete engorgement of the breast. After the breast has been nursed and pumped, the hyperæmia bell is applied four times each day. A coating of vaseline is put around the edge of the glass where it touches the skin, the bell is adapted to the breast and the air exhausted until the resulting engorgement becomes distinctly uncomfortable at which tension it is kept for 15 minutes each time. The tension should not be great enough to produce pain, or hæmorrhage into the tissues occurs, and the breast is harmed. When the tension is right, the breast

is usually slightly cyanotic and milk begins to escape from the nipple. Not only is this of benefit in supplying hyperæmia with resulting increased secretion, but the tension may cause plugs to escape from the milk ducts and produce an easier flow of milk. The patient soon learns how to manage this detail in her treatment without supervision.

I have repeatedly had patients in whom the amount of milk obtained was only one quarter to one ounce at a feeding on the seventh to tenth day of the puerperium, and, by using the means outlined above, it has been possible to discontinue supplementary feeding in a week to ten days, with the result that the mother furnished sufficient milk and continued to nurse the child unaided for nine months or more.

SMALL DOSES OF PITUITRIN IN OBSTETRICS¹

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IN pituitrin we have an oxytocic that is safe when used rightly, generally prompt in action, and one that may be given during any stage of normal labor.

In this paper I shall not attempt to review the literature or to discuss the physiological properties of pituitrin, but shall give you a resume of my experience with this drug in one hundred and fifty cases. The drug was given undiluted and intramuscularly. It was found that injections into the biceps gave promptest, most uniform, and best results. Increased uterine contraction and pains began almost immediately in some cases. Twelve minutes was the longest time I ever had to wait for a definite reaction. In only one case did pituitrin fail to work. The patient was a primipara, twenty-eight years old. The pelvis was slightly contracted. She had been in labor for thirty-six hours. The cervix was three-fourths dilated when the pains stopped. She was given two doses of 1 ccm. each of pituitrin from a one-ounce bulk bottle at half-hour intervals, without any results. After allowing her to rest for several hours she finally delivered herself. A specimen of the pituitrin used in this case was found by laboratory tests to be practically inert. Since then I have been using the 1 ccm. vials with uniformly good results.

Previous to January 1, 1912, I had been using pituitrin in 1 ccm. doses, but the severe reaction

characterized by the excessive, continuous, almost tetanic-like bearing-down labor pains, the loss of control over the mother, her intense suffering, the dangers to herself and the child, as the following three cases will illustrate induced me to try smaller doses.

CASE 1. Mrs. W., III para, a well-built woman with a large pelvis. The perineum was badly lacerated from her previous confinements and she also had a prominent gaster which however caused her very little inconvenience. The cervix was almost dilated and the parts were regular and weak. The fetal head was high up in the pelvis in the L. O. A position. One cubic centimeter of pituitrin induced severe labor pains within a few minutes and a ten-pound child was precipitated through the vulva. The infant's head was not molded; there was a profuse sero-sanguineous discharge from the nose, and the child died six hours later, probably from a fracture at the base of the skull.

CASE 2. Mrs. N., a II para, whose previous confinements were both normal. Examination showed about the same conditions as in the above case. Five minutes after the injection she gave birth to a seven and a half-pound cyanotic child which died in convulsions ten hours later.

CASE 3. Mrs. C., a II para, both of whose children were born without any difficulty, although the labors were somewhat prolonged. When the cervix was almost completely dilated, 1 ccm. of pituitrin was injected. Severe pains started within a few minutes and forced a seven-pound infant through the perineum, causing a very bad laceration.

Since the above unfortunate results, I have used the two- or three-minim doses of pituitrin

in various stages of labor with perfect results. Twenty-nine primiparae and sixty-seven multiparae required each only one injection. The infants varied in weight from four to twelve pounds.

The following three cases will illustrate the use of the drug at different stages of normal labor:

CASE 1 Mrs. R., age 19, primipara, the pelvis was normal and the foetal head in the L O A position. The patient had been having vague, irregular pains every ten to fifteen minutes for twelve hours with no apparent result when she arrived at the East Fifty-Fifth Street Hospital. Three minutes after the injection of two minims of pituitrin, definite, firm, regular labor pains began. The cervix was completely dilated within two and a half hours, and a seven pound child was born two hours later.

CASE 2 Mrs. S., age 35, III para, she entered Maternity Hospital at 7 p. m., having irregular weak pains, which stopped completely about midnight. On examination at 10 o'clock the following morning the cervix admitted two fingers. Five minutes after the injection of four minims of pituitrin, strong, regular bearing-down pains began and she gave birth to a seven and one-half pound babe fifty minutes later. There were no lacerations of any of the maternal parts.

CASE 3 Mrs. M., primipara, examination at St. Ann's Hospital showed a normal pelvis, cervix completely dilated, the membranes ruptured, the foetal head in the first position and resting on the perineum. The patient felt very tired and could not make use of the weak labor pains that occurred every three minutes. Almost immediately after the injection of two minims of pituitrin good strong pains began, the mother gained strength, and ten minutes later an eight and a half pound infant was born.

In thirteen cases, five of which were primiparae, two to four doses were given at intervals of one half to three-quarters of an hour with very satisfactory results. One of these cases was a V para, a very frail woman with a stretched out, weakened abdominal wall. She gave birth to an eleven and a half pound child six hours after the beginning of labor. Without the use of pituitrin she would either have suffered for many hours longer or a forceps delivery would have been necessary.

Another woman, a VI para, was tubercular, very weak, and unable to help herself. She required four injections during labor. She went through her confinement very nicely and six months later did not seem any the worse for her experience. Many of these cases were normal deliveries, but slow and tiresome. Several injections at varying intervals certainly helped to shorten the mental and physical sufferings of these patients.

In twenty-six cases, sixteen primiparae and ten multiparae, medium or low forceps were used to help terminate labor. The small doses of pituitrin had caused good strong uterine contractions, but owing to the following conditions

the deliveries had to be assisted. Twelve women had various degrees of contracted pelvis, and four had large pendulous abdomens and could not bear down during the pains. In four cases the foetal heads were in the R. O. P position and would not rotate. In four others the foetal heads would not mold, while in the remaining two cases the children were very large. Six of the multiparae had been delivered with forceps in previous confinements. Four women who had in their previous confinements been delivered with the aid of forceps were able to give birth in their last labors with the assistance of pituitrin only.

So far, I have limited my paper to normal or nearly normal obstetrical cases. In the following I shall try to illustrate the use of pituitrin in abnormal cases. In this group there are two breech cases, two sets of twins, two cases of premature labor, one case each of bronchitis and asthma, two instances of dry birth, and one of induced labor.

The following clearly demonstrates the value of pituitrin in breech cases:

Mrs. S., age 30, married 13 years, VIII para; a frail little woman, very anæmic and weak. Her previous confinements were all normal. At the end of twelve hours of regular labor pains, the cervix was completely dilated, the membranes were ruptured, and the breech was resting on the perineum. The patient was very tired. The labor pains ceased and she was unable to expel the child. Two minutes after an injection of two minims of pituitrin, strong bearing down pains began and continued until the child was born five minutes later.

The other breech case was almost identical with the above.

Labor in twin cases as a rule is slow, tedious, and exhausting. The pains are generally indefinite and diffuse. The following two cases will show the marked benefit of small doses of pituitrin.

CASE 1 Mrs. M., primipara, in labor thirty six hours. The pains were variable and caused very little results. A diagnosis of twin pregnancy was made. When the cervix was two-thirds dilated, two minims of pituitrin were given. Good strong bearing-down pains immediately began and a five pound child was born fifteen minutes later. The uterine contractions did not abate and, after rupturing the second membranes, another infant, weighing five and a half pounds, was delivered within five minutes.

CASE 2 Mrs. J., primipara. After the birth of the first child, which weighed six pounds, labor pains ceased and the uterus began to relax. Three minims of pituitrin immediately started strong labor pains, and within a few minutes the second child was born.

In two cases of premature labor at six and a half and seven and a half months respectively, and two cases of dead macerated full-term pregnancies about the size of six month fetuses, the

cervices were about two-thirds dilated, but the pains were slow and weak. Injections of two minims of pituitrin in each case caused prompt response, and the termination of the labors varied from ten minutes to half an hour.

The following two cases are very interesting:

CASE 1 Mrs R, age 36, V para. All were easy confinements, but during the last two months she suffered from a severe bronchitis. Drugs had very little effect on it. The coughing spells at times were so severe that often she became livid and almost choked. When labor pains began she was very weak and emaciated. Every time she tried to bear down, the coughing would prevent her from doing much. Four minims of pituitrin were given after the cervix was two-thirds dilated. Good strong labor pains began within a few minutes, and a seven pound babe was born twenty minutes later. After the confinement the bronchitis was easily cured.

CASE 2 Mrs F, age 22, a III para, suffered from severe bronchitis and asthma which increased as the pregnancy advanced. When the cervix was partly dilated, three minims of pituitrin produced the same striking results as in the above case.

Few conditions in obstetrics are more dreaded by the obstetrician, and harder or more exhausting to the patient, than dry birth. Labor is greatly delayed, the suffering to the woman is more intense, and the dangers to the child are increased. With the aid of small doses of pituitrin much can be done in these conditions as the following cases will show.

CASE 1 Mrs G, age 42, IV para, youngest child twelve years old. While getting off a street car at 10 p.m., the membranes ruptured. Slight, indefinite labor pains began about one hour later. At 12:15 a.m. the cervix barely admitted two fingers. The fetal head was in the third position and the pains were irregular, occurring every ten to fifteen minutes. Within ten minutes after the injection of two minims of pituitrin, strong, regular pains began at two-minute intervals. At 5 a.m. a seven-pound-ounce child was delivered with low forceps, the head failing to rotate into the anterior position.

CASE 2 Mrs C, age 19, primipara, a small woman whose pelvic measurements showed a slight general contraction. The membranes ruptured suddenly without pains about 10 p.m. Examination showed no dilatation of the cervix, and the head was unengaged. About one hour after arriving at the hospital irregular ten to fifteen minute vague labor pains began. Ten minutes after the injection of two minims of pituitrin definite regular two to three minute bearing down pains began and lasted about an hour and a half. The cervix now admitted two fingers. Under anesthesia, a medium sized Barnes bag was inserted and filled with sterile water. At 2 a.m. her pains were again weak, and two minims of pituitrin were again given. At 5 a.m. the bag was expelled. The pains then stopped but began soon after a third injection and a normal, healthy, six and three-fourths-pound babe was born at 7:30 a.m. nine and a half hours after the rupture of the membranes.

The last case which I will report in this paper shows the danger pituitrin may cause when there is a malposition of the child.

Mrs P, age 32, a II para, whose youngest child was eight years old. Both were normal deliveries. Two years before, she had had an attack of pulmonary tuberculosis from which she recovered in about six months. Shortly after returning from the sanitarium an exploratory laparotomy on account of severe, indefinite abdominal pains was performed by one of our leading surgeons. The incision extended from the tenth costal cartilage to Poupart's ligament. No gross pathological lesion was found and the patient made an uneventful recovery. Six months later she became pregnant. During the seventh month the lower part of the scar opened. She was kept in bed during the next six weeks, but instead of healing, the scar gradually opened more and more. It was then decided to induce labor with bougies. Two were inserted and the vagina packed at 10 a.m. Labor pains began late in the afternoon. They were infrequent, irregular, and exhausting to the patient, continuing for thirty-two hours. Two minims of pituitrin were given at 7 p.m. Good, regular bearing-down pains began within a few minutes, causing the patient much suffering and a marked tension on the abdominal scar. She was placed on the operating table, and under light anesthesia the vaginal packing and the bougies were removed. The cervix was about two-thirds dilated, but the head was not engaged. The severe pressure of the head against the brim of the pelvis, narrowed by the bougies, forced the head up and the shoulders down. While dilating the cervix bimanually, the membranes ruptured and the cord prolapsed. While I was doing a version, the uterine contracting ring became so firm that it was almost impossible for me to remove my hand. Under deep anesthesia the fetus was with difficulty turned and delivered up to the umbilicus. The ring had contracted around the child's neck and it took considerable time to deliver the suffocated body.

The following are some observations not mentioned in the text of this paper, but which I have also noted in the foregoing cases. (1) No infection of the arm followed the injection of pituitrin. (2) One cubic centimeter ampule was often used for three or four cases. (3) Some patients, when questioned, complained of stronger after pains following the injection of pituitrin than in their previous confinements. A word of warning, however, will not be amiss: the uterus should be watched, for, following the relaxation of a strongly contracted uterus, there is danger of post partum hemorrhage. (4) The patient should not be left alone after an injection, for labor may progress much faster than examination might indicate.

CONCLUSIONS

- 1 Pituitrin is an ideal oxytocic, in that it is safe when properly used.
- 2 It may be given in any stage of normal labor.
- 3 Intramuscular injections into the biceps give the most prompt and best results.
- 4 Some definite and immediate change in the labor pains after an injection of a small dose of pituitrin from the sealed ampules nearly always occurred.

5 Pituitrin will help to differentiate true from false labor pains, but will not induce pains

6 Small doses influence the pains and can do very little harm, but with large doses the uterine contractions are beyond control

7 The infant mortality and the morbidity of the mothers are much greater when big doses of pituitrin are given

8. In normal labor, small doses of pituitrin will shorten the time of labor from two to twelve or more hours

9 Occasionally, several small doses at intervals may be necessary to get the desired results

10 Pituitrin does not take the place of forceps, but if properly used makes a forceps case easier

11 The drug acted satisfactorily in breech presentations, and also in twin and dry-labor cases

A NEW TONSIL-HOLDING FORCEPS

By STEPHEN C. GLIDDEN, M.D. DANVILLE, ILLINOIS

THE forceps are made on the same principle as are the alligator jaw ear forceps. The holding teeth are made similar to those in a vulsellum forceps. The opening between the teeth is $1\frac{1}{8}$ inches allowing the tonsil to be firmly grasped either longitudinally or crosswise. Because of the acute angle the handle can be used on either side of the throat without being in the operator's way. The lock is placed at the end of the handle and is made small enough to allow a snare to be slipped over the instrument without removing it after it is placed on the tonsil.



The advantages are. The forceps are compact, they are easy to handle and have a firm gripping power without obstructing the operator's field of vision.

CORRESPONDENCE

RÖNTGEN ILLUSTRATIONS

Dr. Edward H. Skinner of Kansas City, Missouri has submitted to us the following suggestions concerning making X ray reproductions uniform.

There is not sufficient uniformity in the illustrations of roentgen articles. One notices so many reproductions of chest and abdominal negatives which force one to imagine that he is looking through the body in the postero-anterior position. It would be much better to standardize these cuts so that all of them will appear to the reader as antero-posterior views. This is the usual way physicians have of examining a patient.

There need be no difficulty in securing half-tones which will always appear this way because any reproduction can be reversed if necessary in the lithographic process.

If the editors of journals would insist upon this, one would not be required to look upon a reproduction of a bismuth-filled stomach as if he were looking through the patient's back. It is not always possible to furnish the lithographer with a print which gives the correct perspective but the lithographer can easily reverse the print if necessary, so that the reader will always observe the patient antero-posteriorly.

One may also obtain increased sharpness in the roentgen illustrations by a series of reductions in the size of the lithographic cut. For instance a 14 x 17 negative of the bismuth-filled gastro-intestinal tract can be reduced to an 8 x 10 size, and this to a 4 x 5 size. Each reduction adds sharpness to the outlines.

TRANSACTIONS OF SOCIETIES

CHICAGO GYNECOLOGICAL SOCIETY

REGULAR MEETING HELD JUNE 18 1915, WITH THE PRESIDENT, DR ROBERT T GILLMORL,
IN THE CHAIR

DR RUDOLPH W HOLMES read a paper entitled "Obstetrics, a Lost Art, A Criticism against the Promiscuous Indications for Caesarean Section" (See p 636)

DISCUSSION

DR HENRY F LEWIS Inasmuch as Dr Holmes distrusts the section scar as a source of weakness and consequent danger to the patient in the event of a second pregnancy would he advise sterilization at the time of the caesarean section to do away with this danger? I quite agree with him that no one can be assured of the strength of his section scar in the uterus no matter if he personally has made it and has used the greatest care in the closing of it Every scar, no matter where it is located is connective tissue and no one can guarantee that a scar will not rupture

DR CHAS S BACON I consider that Dr Holmes paper is a very timely and important one The necessity of subsequent caesarean sections in the event of subsequent pregnancies is an important element of consideration when weighing the indications for a caesarean section in such diseases as eclampsia for instance I do not believe however that I would sterilize a young primipara but believe that in subsequent labors it should be seriously weighed When desired by the patient, though in particular cases I urge against it I never have refused to follow the desires of the patient In placenta previa age general health and many other factors must be weighed in arriving at a decision, for instance a central placenta previa in a primipara of 35 might lead to a caesarean section when in a young woman it would not I cannot agree with Dr Holmes that a rigid cervix cannot exist with placenta previa I have one case particularly in mind where this combination existed and where a section probably would have saved both mother and child but where a delivery through the natural passages caused the death of both However I believe as does Dr Holmes that to advise caesarean section for placenta previa under all conditions is very questionable obstetrics

DR MARK J GOODRICH What is Dr Holmes attitude toward the multipara with a minor contraction who has a typical history of increasing difficulty at each subsequent labor because of the natural increased weight of subsequent children and

gradually waning powers of the uterine muscle? Would he prefer to do a section and sterilize her provided she has several children alive or would he subject her to a difficult high forceps or other operation through the natural passages?

DR HOLMES calls attention to the factors influencing the diagnosis of placenta previa totalis Every placenta praevia is complete at first one feels the placenta on all sides with one finger dilatation With advanced dilatation however the diagnosis may have to be changed, since the membranes may then be palpated and the placenta is marginal at this stage

DR W A N DORLAND I think the operative furor for caesarean section at the present time is comparable to the operative furor seen in pelvic surgery some fifteen to twenty years ago when ovaries were removed on all sorts of indications I confidently believe that in the future the present furor will be held just as responsible for harm as we now look upon the interfering and meddling gynecology of years ago The man who does a section because there is a fibroid in the fundus or anterior wall of the uterus, and because of this only is maltreating his patient while if a fibroid is obstructing the outlet it is just as urgent an indication as is a bony obstruction to the natural birth In considering the merits of caesarean section in eclampsia one great item is the larger number of infants saved than by other methods

DR CURRY CUMBERSON It cannot be gainsaid that too many caesarean sections are done That a woman who has had a caesarean section subsequently is delivered by natural passages is no proof of the lasting strength of her uterine scar In one case I attended the caesarean section had been performed by one of our greatest experts and the patient was subsequently safely delivered by low forceps, but in her third labor she was brought to the maternity in a moribund state with a ruptured uterus

DR JOSEPH BARR At the Michael Reese Hospital we are as strict in the indications for caesarean section as is Dr Holmes as can be seen from his paper On a charity service that averages one thousand cases a year I do not remember that we have ever had a caesarean section, pelvic indications being absent among the women coming to us During the last winter we had seventeen cases of eclampsia all were treated according to Stroganoff with subsequent delivery through the natural channel

All the mothers recovered and thirteen living babies were delivered.

Dr. EMIL RIES I commend the stand of Dr. Holmes against the loose indications for cesarean section and believe that Dr. Holmes' paper should be given for publication to a journal reaching general practitioners. He tells of an instance where a physician performed a cesarean section upon the mother of a family of four children because she was one week over the date of her expected confinement, and for no other reason, and the woman died of the operation. Such a medical tragedy is terrible and such a physician should in some way pay the penalty of his misdeed.

I am interested in Dr. Holmes' reference to the value of rectal examination. I do not know that this is recommended in any textbook, and I have read no magazine articles in which this safe means of diagnosis was advocated. Twenty-three years ago I first advised rectal examination. As a new departure it received a great deal of criticism as all new methods do. I should like to know for my personal satisfaction how extensive the practice of rectal examination is, and how many members of this society are acquainted with it.

Dr. N. SPROAT HEANEY Five years ago I know that several members of this society who now are strong advocates of rectal examination were unacquainted with its virtues. I teach the students and my internes this valuable diagnostic aid. Only operative cases at the Presbyterian Hospital are examined vaginally, cases that confine normally rarely receive a vaginal examination during labor.

How many members of this society are frequently called to see cases presenting abnormalities during labor? Not many. The general practitioner does not see difficulties in time to call counsel or if he does he considers himself all sufficient to overcome the difficulties. The surgeons raise a hue and cry against the prevalence of bad surgery, but bad surgery is nothing compared to the rotten state of obstetrical practice. My chief objection to cesarean section is that it is spectacular and easy, these two factors are the direct cause of so many contra-indicated cesarean sections. It would be a much better thing for American women in general if the operation were not so simple and carried with it a much higher immediate mortality.

Dr. WILLIAM HEWITT Would Dr. Holmes do a cesarean section on a woman because of coexistent pyelitis and rectal fistula? What would Dr. Holmes' attitude relative to cesarean section, be in the case of a primipara with a heart lesion?

Dr. HOLMES (closing) The dictum "once a cesarean always a cesarean" is a dictum which is being more and more widely adopted. Dr. Webster in a former meeting denied this dictum but has subsequently changed his opinion. How the wound is sewn I believe is important and decreases the risk, but, nevertheless none can estimate the staying powers of catgut or the phagocytic activity of the uterine wall. Each case is to be regarded as liable

to rupture and should not be subjected to labor. In the first section I do not take up the question of sterilizing, if suggested by the patient it may be performed if apparently justified by a full consideration of the circumstances. In the second or subsequent section, I explain the operation of sterilizing to the patient, if she has a living child already, and allow the patient to decide this point herself. In other words, I would much rather in the first labor take much greater chances with that child in the interests of her potential capacity as a mother of several children. The age of the patient alone should never be the sole indication for cesarean section, for the soft parts do not as frequently as thought cause increased difficulty with age. The chances of a primipara at 40 having a rigid cervix or faulty uterine muscle through acquired disease, as inflammation and tumor, is of course greater, but age alone is a factor of no consideration. The case of Dr. Goldstone's is a fit subject for cesarean section with excision of the uterine ends of the tubes.

I see no reason for doing a section on a woman with a pyelitis or with a rectal fistula either alone or together. The possibility of the infection spreading up the birth canal is just as great where the child has been removed by cesarean section, and once in the uterus the sectioned uterus is much less resistant than if it had no wound in it. This is a typical example of faulty knowledge of pathology in establishing the indication for section. I believe that a woman with valvular heart lesion should not marry or get pregnant, but when pregnant our stand should rest upon the character of the heart lesion. I have repeatedly seen women go unscathed through pregnancy and labor and the puerperium with marked anatomical valvular heart lesions. The fact that a valvular heart lesion exists never brings a cesarean into consideration. If the woman has had at some time a broken compensation, no matter if apparently recovered, or if she has a myocarditis and especially if she has at present suggestive condition of broken compensation, that patient cannot stand the stress of an average labor and the question of a cesarean section and sterilization may well be taken under advisement as the possibility of least harm. Rectal examination is of the greatest help in labor, and I have taught my students it for years. It is of great benefit in complicated cases, because if the case becomes operative the woman is not already infected by frequent vaginal examinations.

THE MANAGEMENT OF DEFICIENT LACTATION

Dr. N. Sproat Heaney read a paper entitled "Management of Deficient Lactation." See p. 657.

DISCUSSION

Dr. BACON This is a subject that has interested me for years and it is enjoyable to know that others are making especial efforts in this line. The attention to the breasts is left too much solely to the ingenuity of the nurse, who receives no instruction

in this important part of obstetrics. The physician has to supervise the attention of the babe if he expects to have lactation persist in a high percentage of cases. The effect of the psychic influence cannot be overestimated in its effect on milk secretion. Painful fissures in nipples may retard lactation, and thus deserve particular attention. When one breast does not yield enough, both breasts may, so that a child may begin to gain if it is given both breasts each nursing, the first one for 15 minutes, the second for five minutes. Of course, I believe in more frequent feedings than six times daily. Frequently the breasts may be much more completely emptied and therefore stimulated if milked by hand than if pumped. The child should be made to gain by being given supplementary feedings and as Dr. Heaney says its improved condition will help it more thoroughly to stimulate its mother's breast. Substitute feedings should never be employed, as the breast is thereby rested for too long intervals.

DR. DANFORTH. I have used hyperemia in many cases and am positive of its beneficial effects. Its use should be instituted early if the most benefit is to be obtained.

DR. A. BELCHAM KEYES. Of great importance in preparing a mother for the capacity of nursing is

the preparation of the nipples. She should for weeks preceding delivery pull and massage the nipples so as to make them more readily grasped by the infant.

DR. HEANEY (closing). Much information of value in the understanding of human lactation can be gained by studying the feeding and general management of lactation in scientific dairy establishments. Beyond an abundantly rich mixed diet there is nothing in the selection of food to influence certain constituents of the milk. Each individual has personal peculiarities regarding the constituents of her own milk, which vary but slightly throughout an entire lactation. The end milk obtained is much richer in fat than the first, and for this reason it may occasionally be better to put a child on each breast for a short period when a weaker milk is wanted, for reasons aside from quantity. With a normal child, however, the great factor is never quality but quantity that is at fault, either the child doesn't get enough or it gets too much, and the infant's troubles are originally due to this variation. I am certain that if you use hyperemia as a means of stimulating deficient lactation, you will be just as ardent in its use as are others of my friends who have taken it up.

BOOKS RECEIVED

Books received are acknowledged in this department, and such acknowledgment must be regarded as a sufficient return for the courtesy of the sender. Selections will be made for review in the interests of our readers and as space permits.

THE TREATMENT OF FRACTURES. By Charles Locke Seudder, M.D. Eighth Edition. Philadelphia and London: W. B. Saunders Company, 1915.

MODERN ASPECTS OF THE CIRCULATION IN HEALTH AND DISEASE. By Carl J. Wiggers, M.D. Philadelphia and New York: Lea & Febiger, 1915.

APPLIED IMMUNOLOGY. The practical application of sera and bacterins prophylactically, diagnostically, and therapeutically. By B. A. Thomas, A.M., M.D., and R. H. Ivy, M.D., D.D.S. Philadelphia and London: J. B. Lippincott Company, 1915.

SIMPLIFIED INFANT FEEDING. With seventy-five illustrative cases. By Roger H. Dennett, B.S., M.D. Philadelphia and London: J. B. Lippincott Co., 1915.

THE CLINICS OF JOHN B. MURPHY, M.D. AT MERCY HOSPITAL, CHICAGO. Vol. IV, No. 3. Philadelphia and London: W. B. Saunders Company, 1915.

BEAUTY AND MOTHERHOOD. By Ferdinand Herb, M.D. Chicago: The Medico Press, 1915.

THE MEDICAL CLINICS OF CHICAGO. Vol. I, No. 1. Philadelphia and London: W. B. Saunders Co., 1915.

TWILIGHT SLEEP, AMNESIA AND ANAESTHESIA IN PARTURITION. By Alfred M. Hellman, B.A., M.D., F.A.C.S. New York: Paul B. Hoeber, 1915.

TEXTBOOK OF SURGERY for students and practitioners. By George Emerson Brewer, A.M., M.D. Philadelphia and New York: Lea & Febiger, 1915.

POTTER'S COMPEND OF HUMAN ANATOMY. Revised by D. Gregg Metheny, M.D., L.R.C.P. and S. L. P. S. Eighth edition. Philadelphia: P. Blakiston's Son & Co., 1915.

TWELVE LECTURES ON THE MODERN TREATMENT OF GONORRHEA IN THE MALE. By Dr. P. Asch (Strassburg). Translated and Annotated by Paxton L. Gardner, M.D. New York: Reiman Company, 1915.

A TEXTBOOK OF CHEMISTRY AND CHEMICAL URINALYSIS FOR NURSES. By Harold L. Amoss, M.D. Philadelphia and New York: Lea & Febiger, 1915.

CANCER: ITS STUDY AND PREVENTION. By Howard Canning Taylor, M.D. Philadelphia and New York: Lea & Febiger, 1915.

CASE HISTORIES IN DISEASES OF WOMEN INCLUDING ABNORMALITIES OF PREGNANCY, LABOR, AND PuerfLEURIA. A clinical study of pathological conditions characteristic of the five periods of woman's life. By Charles M. Green, A.B., M.D. Boston: W. M. Leonard, 1915.

THE PRACTICAL MEDICINE SERIES, VOL. IV, GYNECOLOGY. Edited by Emilius C. Dudley, A.M., M.D., and Herbert M. Stone, M.D. Chicago: The Year Book Publishers, 1915.

A MANUAL OF GYNECOLOGY for students and practitioners. By Samuel J. Cameron. London: Liddard Arnold, New York: Longmans, Green & Co., 1915.

THE PRINCIPLES AND PRACTICE OF OBSTETRICS. By Joseph B. De Lee, A.M., M.D. Second edition thoroughly revised. Philadelphia and London: W. B. Saunders Co., 1915.

COLLECTED PAPERS FROM THE RESEARCH LABORATORY OF PARKER, DAVIS & Co., Detroit, 1915.

BOOK REVIEWS

A CRITIQUE OF NEW BOOKS IN SURGERY

By MAJOR G SEELIG, M D St LOUIS, MISSOURI

WE have commented before, in this department on the unusual interest connected with tracing tendencies in current medical literature. Those with eyes open for such things must have noted the recent strong current of comment on the proper use of English as a means of conveying purely medical thought. From widely separated quarters the slogan of "Better English" has been bugled—Philadelphia, New York, and Rochester. And 'tis well 'tis so, for if operative procedures on patients were as disastrous as are the mutilating attacks of medical authors upon the English language, our operating rooms would have to be cordoned with police. One must not draw the inference that the sins of faulty composition are limited to medical literature. Only recently, Walter Lippmann, in commenting in *The New Republic* on a certain unnamed political writer said that he must have been toothless judging from the difficulty one experienced in understanding him. Our interest centers, however as a matter of course in purely medical composition.

Personally, I believe that the sole value of a campaign for better English lies in shaming men into providing suitably decent clothes for their thoughts. I doubt very much whether men who have graduated in medicine can at that late day be taught to use their mother tongue properly to say nothing of forcefully and clearly. Good English is largely a question of mother's milk and lactation is rarely prolonged beyond undergraduate days. But what men can be taught is that the ordinary amenities demand as tactful a concealment of poverty of verbiage and thought as is ordinarily practiced to conceal the lack of more maternal things. There is always a good natured critic at hand to whip a reasonable amount of correctness, clearness, and conclusiveness into almost any worthy medical exposition. And that is what is meant by "shamed into providing suitably decent clothes"—suitable clothes willy nilly if not of your own selection then of the selection of a more tasteful dresser of thoughts.

Of course, no one could successfully maintain the thesis that any age is too late to study profitably, English, or any other subject. The fact remains, however, that the average man who writes poorly at the age of thirty, can correct his diction with difficulty so nearly insuperable, that the task becomes an impossible one. McCrae's plea for a

more accurate use of words is timely (*Journal American Medical Association*, July 10, 1915), but the incorrect use of words is only one difficulty, and not the greatest, by any manner or means. Many men who use their words with scientific precision succeed in putting them together so that the intended thought is merely a mess of scrambled cerebration. Most medical writing is expository, clearness is the first essential of good exposition, and in order to obtain clearness it is necessary not only to use words properly, but also to group them properly as sentences, to coordinate sentences properly as paragraphs, and to arrange paragraphs into a unified whole. A German once said that by a sort of gravity, our thoughts fell easily onto paper, and against that same gravity, rose with difficulty from the paper to the mind of the reader. Pity 'tis, 'tis true.

This first book for review¹ illustrates rather concretely some of the thoughts expressed above. Although essentially a surgical product, the volume deals so largely with the purely medical phase of the problem discussed that I have asked for medical consultation with Dr. Sale, who responded graciously with the following criticism. The presidential address before the section on internal medicine, which met recently in San Francisco, sounded a timely warning. That the leaders in American medicine should start propaganda for greater accuracy in the choice and use of words is most desirable. We cannot all write like William Osler, Clifford Alburt Lauder Brunton or Arbuthnot Lane but we can avoid gross errors. This, the author of the book under discussion, has failed to do. As a literary production the book is a sad example. The volume is indeed rather remarkable in that almost on every page we find an unfortunate phrase a grammatical error or a syntactic sin.

Let us quote at random. On page 18 the author writes "prolonged diarrhoea through loss of sleep drain upon the system worry digestive disturbances and auto intoxication (which frequently accompanies it and tends to the production of other circulatory defects) lowers the vitality and bodily resistance and altogether makes the patient an easy prey to microbes and is often the direct source of pathologic changes within the gut, in

¹DIARRHEAL INFLAMMATORY OBSTRUCTIVE AND PARASITIC DISEASES OF THE GASTRO-INTESTINAL TRACT. By Samuel Goodwin (apt M D LL D Philadelphia and London W B Saunders Company 1915

close proximity to it, and in distant parts, because the irritating fluid discharges serve to erode or break the continuity of the intestinal mucosa, permit specific and non-specific bacteria to enter the circulation and be carried to remote parts, where they may cause trouble, or penetrate deeply into or through the intestinal wall with the resultant production of deep seated mixed infection, ulcers, abscesses, fistulae, pyæmia, peritonitis, septic pneumonia, or other serious complications." Shadys of Beowulf, Chaucer, Shakespeare, Addison Steele, and Macaulay!

On page 321 we read that "one might as well attempt to get up a single definition which would define scarlet fever, whooping cough, chicken pox etc., as to seek to accomplish the same for dysentery because of its variegated [sic] etiology, changeable [sic] intestinal pathology, and the dissimilar manifestations in the different forms of the disease." If the publishers would authorize the change, we should amend this paragraph to make it read about as follows "One might as well attempt to define scarlet fever or whooping cough as to define dysentery with its complex etiology its diverse intestinal lesions, and its varied manifestations."

On page 407 we are informed that "in some instances patients are desperately ill throughout the attack (bacillary colitis), the accompanying symptoms are out of all proportion to the intestinal lesions, and they may be difficult or impossible to discover." The reader must surely have grave doubt whether the patients or the symptoms or the lesions are so difficult of discovery.

On page 519 the author takes a strange hold on the English language as follows "Recent accumulations of the above types may induce diarrhoea through obstructing the gut as would a cancer or other tumor, direct irritation to the bowel by setting up a localized catarrh favoring the retention of putrefying material and the multiplication of the normal intestinal pathogenic bacteria and their toxins, which lead to increased peristalsis glandular secretion, and diarrhoea, owing to their influence upon the local and general mechanism." After the reader like a modern Theseus has tried to find his way through this labyrinth is he not justified in crying aloud "Light more light?"

As comment on the foregoing it may be urged that the author did not purpose to write a treatise on English and that the reviewer should confine his criticism to the matter of the book. Dr. Grant exhibits an intimate acquaintance with his subject matter and a command of the literature. The book represents a tremendous amount of work and the reader gains the impression that the author is probably a clever teacher and an interesting clinician, even though this particular book is of doubtful value.

The book is too voluminous owing partly to an unhappy padding but even more to the inclusion of discussions that do not seem to be in place in a book with this title. Measles scarlet fever

varicella, whooping cough, alcoholism, methemoglobinæmia, etc., are not diseases of the gastrointestinal tract. The diarrhoea that occurs in these conditions is purely symptomatic and should be discussed in a textbook on general medicine, or in special treatises.

The author valiantly champions surgical intervention in very many conditions. His enthusiasm often carries him too far. A work such as this is bound to result in much needless and often pernicious surgery. A whole chapter is devoted to the surgical treatment of tuberculosis of the intestines. The author recommends, among other things, entero anastomosis "when there is extensive lung involvement and the patient is greatly debilitated and exhausted." This is indeed radical counsel. To us it seems that ileocaecal tuberculosis, rectal tuberculosis, and strictures resulting from healed ulcers are the only safe and sane indications for operative measures.

In view of the fact that the author discusses diarrhoea in relation to many conditions that are not gastro intestinal, it is surprising that he devotes so little space to intestinal neoplasms. The subject affords a real opportunity to the expert gastro enterologist to do some educational work and to make much needed propaganda. There are several tables for differential diagnosis. These are as useless and misleading as such outlines are bound to be. They have all of them an inherent weakness in that they ignore the fact that we can not, except perhaps in exceptional instances, carry out a plan of terse antithetical characterization of two conditions that have much in common.

One of the main functions of the reviewer should be to assist others in making a choice of books that they would give permanent place on their shelves. For student or practitioner whose means are limited, a discriminating selection is essential and not always easy. To such a one we express reasonable doubt as to whether this book will enhance the real value of his collection.

By fortuitous circumstance the volume of *Collected Papers of the Mayo Clinic*¹ bears on our last motif of English composition, for Mrs. Mellish contributes to this collection "Suggestions for Writers of Medical Papers." This little essay is admirably done so admirably indeed, that we suspect that Mrs. Mellish must be an inestimably valuable factor in toning down and trimming up much of the Mayo Clinic printed product. The essay in its entirety could be well paraphrased as "keep your eye on the ball." And that's why we doubt the resultant value of such advice as Mrs. Mellish furnishes. It is very well and very necessary to counsel steadiness of gaze but it is an entirely different story to attain such a consummation. If any proof were necessary to clinch our seeming

¹ COLLECTED PAPERS OF THE MAYO CLINIC. ROCHESTER, MINN.: 1914. Edited by Mrs. M. H. Mellish. Vol. VI. Philadelphia and London: W. B. Saunders Company, 1915.

pessimism, we could find it close at hand. The following sentence is copied from a paper, published from the Mayo Clinic in one of our weekly journals, within the month (July). "We believe, now, however, that in the patient who is quite relieved by gastro enterostomy for a period, usually under a year, and then develops symptoms similar to those produced by the original lesion, such symptoms being persistent and unrelieved by any medication, that a second ulcer has occurred in the region of the anastomosis must be considered a strong possibility."

But laying aside all thought of mother tongue, one is forced to assume an attitude of admiration for this most excellent collection of work. There are approximately eighty papers by thirty-odd authors. The contributions are grouped under the heads of Alimentary Canal Urogenital Organs, Ductless Glands, Head, Trunk and Extremities, Technic and General Papers.

The papers have been reprinted from current surgical journals, and it is therefore safe to assume that most surgeons have already formed their critical estimate of them. The contributions by Wilson on various pathological aspects of gastric carcinoma are more apt to have escaped surgical notice and they therefore call for special notice lest one miss their fundamental importance, for they represent a very high order of thoughtful, painstaking pathological research. Likewise the papers of Carman on X ray diagnosis call for special mention, in so far as they illustrate the very highest type of correlated laboratory and operating room cooperation. The paper by Sheldon on Pleural Effusion adds very little to that which one finds in the ordinary textbooks, indeed, does not furnish data as satisfactory as that in Leube, Sahli, or Allbutt. The paper by Charles Mayo and Beckman on Visceral Pleurectomy would have been much more satisfying if more had been detailed regarding the purely technical side of the subject.

Naturally, it is impossible to pass in order from paper to paper. The variety of topics, if not bewildering, at least defies detailed critique within limited space. The important point to note is that, thanks to the excellent editing this volume together with the previous ones, and those to come, constitute an invaluable and almost indispensable hand book of surgery.

THIS trilogy¹ by Morris is a purely literary product. The three volumes are not surgical, *sensu strictiori*; and yet we include a review of them

for two very definite reasons. In the first place, a sort of guild pride very properly prompts one surgeon to recognize a special order of merit in another surgeon. Dear old Doctor John Brown still reaps fame for having crystallized his "spare hours" into beautiful prose, and although Dr. Morris's essays hardly measure up with the "Horae Subsecivae" of Brown, they do possess that charm which almost always attends a spare hour labor of love. In the second place, the essays call for comment in that they illustrate what we have not yet referred to in our discussion of written English, namely, grace of style. Although it is true that the tremendous multiplicity of topics discussed and the unfortunately staccato method of discussion militates against that very smoothness of style which we admire in some of our other famous medical essayists, notably, the Browns, Weir Mitchell, Holmes and Osler, and although Dr. Morris himself modestly disclaims the power of literary expression, still there is an admirable virility of tone to much that Morris says, in his pleasing, colloquial fashion, even in spite of the very evident straining to express much of his matter aphoristically.

The titles of the three volumes are not representative except in the very broadest sense. One finds almost any conceivable subject discussed in any of the three volumes, irrespective of title. Indeed, one is at loss to know whether he more admires or wonders at the broad catholicity of taste and thought displayed in the fifteen hundred odd pages,—yes, they are good sized, full fledged books.

Whatever other purpose may be served by a surgical book review, it can hardly be used to clothe an argument of literary or philosophic dissent, so we must, perforce, seemingly agree with all that Dr. Morris says and simply pass him on to our various readers with the assurance that he will beguile their tedium. They will note, just as we have noted, a pleasing, inoffensive egotism, a fantastic tendency toward bizarre coinage (such as "carpender," "hobbeque," "ovisness," and "damrotic"), a somewhat disturbing leaning toward hyperbole, and an ingrained love of out of doors that forces its way into the reader's consciousness as does the odor of new mown hay. Morris is at his very best when in the reminiscent mood of hunter or fisherman, or when expounding nut culture, or describing a scarlet tanager, or telling about the goslings, or Timmie and Dickie, the ducks.

Of course, the experiment of bombarding with three volumes all at once is dangerous for both Dr. Morris and his publishers. Involuntarily the wary reader shies at what he fears may be a literary purge. But believe us on faith, the books are decidedly worth while.

¹ TOMORROW'S TOPICS: SCIENCE, MICROPHONES AND MEN. A SURGEON'S PHILOSOPHY. DOCTORS VERSUS FOLKS. By Robert T. Morris, M.D., Garden City, New York: Doubleday Page and Company, 1915.

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THE END-RESULTS OF SEVENTY CASES OF RENAL TUBERCULOSIS TREATED BY NEPHRECTOMY¹

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INTRODUCTION

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INTRODUCTION

THOUGH many points connected with the diagnosis and treatment of renal tuberculosis have been practically settled during the past ten years much still remains to be done. In expert hands the questions of diagnosis have been well cleared up and the formerly much discussed question of the advisability of surgical treatment has ceased to play an important part. The tendency to watchful waiting which was generally but another name for medical procrastination has considerably abated and there is practically no difference of opinion, among those qualified to express one, that in unilateral renal tuberculosis operation offers the only chance of cure and the so called medical treatment only prolongs the agony.

The scientific world is still waiting for proved cases of renal tuberculosis healed permanently, except by removal of the kidney, either by nature or by art. But though in the field of diagnosis and in the principles of treatment general agreement has been obtained, our knowledge of what actually happens to these patients following nephrectomy is often largely a matter of speculation.

Far too much we have depended upon our impressions, which are notably inaccurate, and have assumed that from these patients no news was good news.

It is, therefore with great pleasure and much profit that I have followed my associate, Dr. Crabtree, in his study of the results of nephrectomy for renal tuberculosis at the Massachusetts General Hospital. The work has been carried out with a care as to detail which will satisfy the most captious and also with complete willingness to accept the showing, no matter what it may be.

His paper raises in my mind again certain questions which have troubled me in the past and upon which it seems to me further work is necessary.

In every series of reported cases of considerable size, as in most of the other operations dealing with tuberculous lesions, there is a certain proportion of the patients who die promptly from general miliary tuberculosis. In addition to this there is a considerable number of patients who, following operation, have a high temperature, a rapid pulse, and all the evidences of profound toxæmia. Most of these patients recover. The minority die with miliary tuberculosis.

¹ From the Records of the Massachusetts General Hospital.

I have been on the whole surprised that this phenomenon has not been more frequent, as, in our efforts to free these generally adherent kidneys, the probability of forcing a considerable amount of toxic material, and even actual bacilli, into the circulation seems overwhelming. I have been led to wonder whether this might not be avoided by an operation planned so as to secure the vessels before manipulation of the kidney. As our technique improves and our mortality becomes lower, this question must certainly be taken up and unless it should appear that the renal vein is not the chief source of infectious supply it would seem to me an important consideration.

The cases here reported by Dr Crabtree, and particularly a number of recent cases of my own, have brought out the fact that operation upon early lesions is no more likely to be attended by a good ultimate result than is operation upon much more advanced lesions. This may, of course, depend upon at least two conditions: first, that the renal

tuberculosis is only an evidence of a generally low resistance to the tubercle bacillus and that the failure of nephrectomy to control the process proved nothing except that it could not have been controlled by any method; or second that the process in the kidney is so early that there has developed no immunity and that if left to itself for a short time such heightened resistance might come. Certainly this apparent fact requires careful consideration and we must either modify our technique so as to avoid the possibility of spreading the infection or take measures to hasten the development of immunity.

While it would seem a pity to do anything which remotely tended to discourage the only just developing enthusiasm for removing the tuberculous kidney at the earliest possible moment, it is clearly necessary to call attention at the present time to what our experience has led us to believe to be a not inconsiderable danger; viz, the lack of resistance in patients with early tuberculous lesions of the kidney.

THE fate of the nephrectomized in renal tuberculosis is not yet a closed book. It is with the purpose of adding to the literature of this important subject that the following data are presented.

The cases studied comprise those treated since the establishment of nephrectomy as a routine treatment for renal tuberculosis up to December 1912. It was not considered advisable to include those cases which were operated upon since this date and which were of less than two years' standing after nephrectomy at the time of beginning this investigation, since this period is not sufficiently long to allow for the recovery of bladder symptoms in the average case. The nephrectomies were performed by a number of surgeons represent many varieties of technique and approximate the average results of good general surgical skill. The cases operated upon in the genito-urinary service in the first two years of its existence are also included. Of these, the great majority was operated upon by Dr Hugh Cabot.

The records of the hospital contain 103 cases operated on within the period designated. Of these, 4 patients died in the hospital. These deaths will be discussed later. Letters were sent out to the 99 patients who left the hospital alive, requesting a visit to the hospital for examination. If the patient were still alive but unable to visit the hospital, he was requested to send a specimen of urine and data as to his condition.

Fifty-one cases reported and were examined or sent letters with urine, more than three-quarters, 45, were seen in person. Eleven letters from friends of patients or from the city clerk report the patient as dead. In the majority of these, the cause of death is given but no necropsies are available. The clinical diagnosis is given and in advanced tuberculosis it is usually a satisfactory explanation of the cause of death. In 19 instances the letters were not returned. In 8 of these cases the records contain notes made one to four years after operation. It is reasonable to suppose that not all of these are dead but

that some are lost through change of address. In 10 instances the letters were returned unclaimed and all efforts to trace the patients through friends or from records of death certificates were fruitless. In 70 of the 99 cases, definite data, more or less complete, were obtained.

The average duration of time since operation, for the series, exclusive of the 4 cases of immediate post-operative death, is 5.6 years. One patient is living 18 years after nephrectomy, one, 15; one, 13, two, 11, and one, 10 years.

The following data were obtained from the hospital records:

Sex. The patients were about equally divided as to sex, there being 34 males and 36 females. In the majority of series reported there is a slight preponderance of males. In 1,176 cases reported by von Frisch, Wildbolz, Asakura, Walker, Guilliard, Tuffier, Albarran, and Braasch there are 633 males and 543 females.

Wildbolz mentions that among women there are larger percentages of cures. This observation is borne out by the fact that in the 9 "unimproved" cases, 8 are male and 1 female. And of the late deaths, 11 are male and 3 female.

Age. There is 1 case of tuberculosis in childhood in this series, a boy 14 years of age. The average age for the series is 34.9 years with extremes of 14 and 65 years. It is well known that renal tuberculosis is a disease of young adult life and these statistics accord with this observation. Braasch found that only 29 per cent of his series were above 40 years of age. Wildbolz reports that of a series of 316 cases, 224 were between 20 and 40 years of age, while only 4 were under 10. Asakura found that of 70 cases, 60 were within the above limits, while none was under 10. Forty-one, or 58.5 per cent, of our cases occurred in the third and fourth decades. The ages as shown in decades are as follows:

	Cases
11 to 20 years	6
21 to 30 years	17
31 to 40 years	24
41 to 50 years	12
51 to 60 years	3
61 to 70 years	1
Age not given	7

A striking fact to be observed is that in the 4 cases in which the patients were over 50 years of age, the lesions were calcareous kidneys with autonephrectomies.

Side. No cases of bilateral renal tuberculosis were knowingly operated upon. It is probable that were these cases seen under the conditions of our present-day clinics and with present-day methods of diagnosis applied, some would be demonstrated to be bilateral infections. A review of our recent out-patient cases shows a larger number of bilateral lesions diagnosed in the past three years than in the decade preceding. The statistics of Kronlein show 92 per cent of cases seen in the routine clinic to be unilateral. There are few statistics on this subject but the evidence goes to show that early tuberculosis is usually unilateral while late tuberculosis is more apt to be bilateral, except in children, where bilateral lesions are common. Kapsammer found in 20,770 autopsies that there were 191 cases of renal tuberculosis of which 67 were unilateral and 124 bilateral. Vigneron out of 250 autopsies found only 123 unilateral cases. Balfour, in the Mayo Clinic, found 80 per cent of the cases unilateral at operation, at autopsy 75 per cent bilateral. Morris found 9 unilateral cases in 72 autopsies.

In our series there were 40 right-sided lesions and 27 left sided, while in 3 the side is not mentioned.

Family history of tuberculosis and definite history of exposure is positive in 10 cases, negative in 38, while in 22 this point was not recorded. There are no satisfactory data as to the conditions under which the patients live.

Duration of symptoms. The average duration of symptoms before operation is 2 years and 6 months, the shortest is 3 weeks and the longest 10 years. Of the 70 cases, only 24 claimed the benefits of operation before one year from the date of appearance of symptoms. This fact may and undoubtedly does have, through extensive bladder involvement, considerable significance in the many cases of troublesome bladder symptoms which have persisted over long periods of time.

In the earliest cases operated upon, even

one case in which there had been but 3 weeks of symptoms preceding operation, a well-marked lesion undoubtedly existed for a considerable time before the onset of symptoms and during this period was absolutely quiescent. It is not known what change takes place in the nature of the lesion at the onset of symptoms, but it is most probable that pyelitis with resulting bladder irritation and infection is the explanation.

Presenting symptom The presenting symptom, i.e., the symptom which first brought to mind the fact that there was some abnormality of the body, shows that bladder irritation was by far the commonest of early symptoms, with pain in the kidney region on the affected side second. Below is given a table of the relative frequency of the presenting symptoms.

	No. of cases	Per cent
Bladder symptoms (bladder pain, frequency, burning, tenesmus etc.)	34	48.5
Pain in the kidney region	25	35.7
Loss of weight and strength	3	
Pain in penis on micturition	2	
Hæmaturia without any other symptom for a time	1	
Chills and fever with pyuria (complicated tuberculosis)	1	
Referred pain (colic) associated with hæmaturia	1	
Acute retention from pus and blood clot	1	

The facts recorded are not sufficiently detailed to allow of extensive generalization as to the character of pain in renal tuberculosis. The data available indicate that pain in the kidney region, whether occurring as presenting symptom or in the course of the disease, is of dull aching character, situated in the costovertebral angle or indefinitely located in the affected side, except in the few cases in which there is hæmorrhage with the passage of blood clot down the ureter, in which cases the character of the pain becomes colicky and is localized and referred as in ureteral calculus. There were no cases of crossed pain, i.e., referred to the unaffected kidney.

In this series of cases dull, aching pain in the kidney region occurring at some time in the course of the disease is recorded in 38 instances or 54.2 per cent, sharp pain in kidney region in short attacks, 10 cases 14.2

per cent; ureteral colic associated with hæmaturia, 11 cases, 15.7 per cent. Bladder pain bears a close relation to other bladder symptoms such as frequency and tenesmus and its frequency of occurrence is that of acute bladder symptoms.

General symptoms of loss of weight, anæmia, loss of strength, anorexia, and an occasional feeling of flushing (temperature) but usually not in marked degree, were observed in three-fourths of the cases.

CLINICAL SIGNS

Temperature In two-thirds of the cases (46) the temperature fluctuated irregularly between normal and 100°. What cultural evidence is available indicates that these were not cases complicated by secondary infection. In 2 cases with secondary infection the temperature rose to 102° to 104° and remained so until operation over a period of 5 and 7 days respectively. In 20 of the cases the temperature was normal. In the remainder of the cases, 3 in number, operation followed immediately on entrance into the hospital.

The urine Sixty-one cases or 87.1 per cent of the cases showed from a trace to the very slightest possible trace of albumin. Only 2 showed none at all, but this was on a single examination. In the remaining 7 no urine analysis had been recorded.

The sediment showed pus in 60 (85.7 per cent) of the cases and microscopic blood in 33 (41.1 per cent). Twelve other cases gave a satisfactory history of having passed blood at some time since the onset of symptoms. In 2 cases a sediment was not done since there was a negative test for albumin, a procedure which is indefensible.

The amount of pus present was sufficient to lead the house officer to describe the urine as cloudy in 38 (55 per cent) of the cases. Blood was macroscopic in but 10 of the cases. The total number of cases in which there was macroscopic or microscopic blood or a satisfactory history of bloody urine at some time since the onset of symptoms was 45 cases or 64.2 per cent of the 70 cases studied.

Casts Four cases showed casts. Three of these could not be traced. The fourth

reported 8 years after operation, having in the mean time developed an epididymitis (tuberculous). His urine still showed a large number of granular casts but he had no oedema and his blood pressure was 150 mm. He had no complaints other than a little frequency. Guinea pig inoculation was negative. Lesions of this nature must be considered toxic and have their origin in the by-products of growth of the infecting organism. The fact that the lesion has not progressed in this case in spite of increased work being thrown upon the remaining kidney leads one to conclude that the progress of the disease ceased after nephrectomy.

OTHER TUBERCULOUS LESIONS

Lung tuberculosis. Thirteen cases (18.5 per cent) in the series showed definite clinical and in some cases X ray evidence of consolidation with or without evidence of activity of the process, or gave a history of unexplained pleurisy. Six of these cases are included in the list of dead under distant mortality. One patient has arrested tuberculosis of the lungs and is now under treatment at a sanitarium. Of the 5 known to have died, there were no necropsies but the city clerk's record shows entry of "death from tuberculosis."

The frequency of occurrence of pulmonary tuberculosis in patients harboring renal tuberculosis is difficult to estimate since few cases operated upon die in the hospital where by post-mortem findings, the presence of lung involvement can be demonstrated. The following interesting observations have been recorded.

Braasch finds that 6 per cent of the cases of renal tuberculosis at the Mayo Clinic had demonstrable lung involvement. Wildbolz found among 76 cases of renal tuberculosis apparently cured by operation only 8 which showed tuberculosis outside the genito-urinary tract; 5 of these were phthisis and 3 adenitis. Israel found that lung tuberculosis was the cause of 45.2 per cent of all late deaths. In Asakura's series all late deaths are ascribed to lung tuberculosis. Kelyack reported (1897) that in autopsies studied with reference to renal tuberculosis 80 per cent had lung tuberculosis. Von Frisch found old lung

foci in all cases operated in his series. Walker from the Johns Hopkins Hospital reports renal tuberculosis in 23 cases out of 482 autopsies performed on patients dead from pulmonary tuberculosis. In these cases the diagnosis of renal involvement was not made since the patients gave no history of renal symptoms. Tilden Brown from the Presbyterian Hospital, New York, reports 68 cases of death from phthisis of which 23 had renal involvement.

It is extremely doubtful if early lesions are recognized and it is almost certain that we miss tuberculosis of the bronchial glands in many cases, however, there is no reason to believe that early tuberculosis of the lungs contra indicates operation.

Tuberculosis of the epididymis was found previous to operation in 3 cases. In the 2 instances in which it was unilateral it occurred on the same side as the kidney lesion. The other case had bilateral epididymitis but the record does not state which side was involved first.

Prostatic tuberculosis. There is insufficient data in our records as to involvement of prostate and seminal vesicles to allow of any conclusions as to frequency. In many instances there is no rectal examination recorded, particularly is this true of the earliest cases, at which time histories were less complete. One case showed tuberculosis of the prostate with negative vesicles. One case was diagnosed as genital tuberculosis without specifications as to what organs were involved. In 14 cases the rectal examination is recorded as negative.

Tuberculosis of the knee was found in 3 cases (4.2 per cent) of the series. In none of these was the process active. Braasch reports 7 per cent joint tuberculosis, 3 per cent active.

Tuberculous adenitis in the glands of the neck was found in 2 cases. They were not active at the time the renal symptoms developed.

Tuberculous stricture of the urethra was found in one case associated with prostatic involvement. The stricture was long, extending from the peno-scrotal angle backward to the end of the bulb. This patient

died and was probably a bilateral case at the time of operation

In all there were 24 "other lesions," i.e., lesions other than the kidney, ureter, and bladder. They occurred in 19 patients. The percentage of patients suffering from other demonstrable tuberculous lesions at the time of operation is 27 per cent.

OPERATION

In a few of the early cases there had been a previous nephrotomy done for tuberculous pyonephrosis or for "perinephritic abscess." All the cases were subsequently treated by nephrectomy and are properly included in this series. The date of the nephrotomy previous to the nephrectomy averaged for the 5 cases 3 years. In 4 there were sinuses, the other was a healed wound at the time of nephrectomy.

In all cases a nephrectomy was performed with a partial ureterectomy with varying lengths of ureter removed. The wounds were all drained and no especial effort was made to sterilize the ureter.

KIDNEY LESION

The nature of the kidney lesion and the relation of the type of lesion to recovery of the patient is shown in the table.

	Cured	Unimproved	Dead	Total
Tuberculous pyonephrosis	14	4	7	25
Autonephrectomy calcified kidney	2		2	4
Early tuberculosis (usually single cavity)	4	3	3	10
Tuberculous nephritis	2			2
Cases diagnosed "Tuberculosis" (extensive involvement)	10	2	7	19
Ureter thick evidently tuberculous	1			1
Normal looking kidney				
Total	41	9	19	70

From the above figures it is apparent that in extensive tuberculous involvement, even in tuberculous pyonephrosis, recovery is the rule, while in early tuberculosis the percentage of cured cases is low.

The relation of pain as a symptom to the character of the pathological lesion is difficult to interpret, yet some interesting facts are presented. In all the cases (25) in which the lesion found was pyonephrosis, there was a history of renal pain. The remaining 13 instances where this symptom was mentioned

were about equally divided between the "early lesions" and "extensive lesions."

The occurrence of pain in pyonephrosis can be properly considered as due to distention. In the "early lesions" and in the 25 instances in which pain was the presenting symptom of the disease, explanation of the symptom on mechanical grounds becomes difficult unless it be due to renal congestion taking place during early stages of infection.

The average duration of time since operation for the series of 70 cases, excluding the 4 immediate deaths, is 5.6 years; for the cases considered cured, 6.2 years; for the unimproved, 4.4 years. Other facts concerning the time element in convalescence will be discussed at another time.

Some interesting data concerning the relation between duration of the disease before operative intervention and the course of convalescence develop from a detailed study of the series. Early lesions in young individuals as a rule have done less well. This observation was borne out particularly in some of our recent cases, not included in this study. Two factors seem to be significant in this connection, one, acquired resistance of the patient and the other, the extent of active perinephritic involvement. Some patients seem to acquire almost no resistance and the disease progresses in an uninterrupted downward course. These patients are not benefited by operation. While some cases which have been operated upon early in the disease have made rapid recovery—one in particular on whom nephrectomy was done in the third week of symptoms was free from symptoms immediately after operation and has remained well since—recovery is not the rule. In other cases in which the symptoms have run 3 to 4 years before operative intervention there has resulted a marked downward course to the disease similar to that of the early cases with marked perinephritis. These cases seem to have little or no resistance to the disease, and nephrectomy does not produce the desired effect of enabling the patient to care for whatever disease is left behind at nephrectomy.

The average age of the cases recorded as

dead or unimproved is 28 years with but 6 cases over 30 years of age and all under 40. All the patients who had passed the thirtieth year had more or less extensive "other lesions" and would properly be considered as having low resistance. The duration of symptoms before operation for the "dead" is 1.5 years, for the "unimproved," 1.8 years, while that for the "cured," it is 3.2 years.

In the face of the above facts, as far as the evidence of this series can influence our opinion, it would seem advisable to select cases for operation and perhaps to wait in some for immunization to take place before performing a nephrectomy. Much more information is essential before such a generalization can be made and there remains but one course in treatment, i.e., nephrectomy, as soon as the diagnosis can be made. The factor of resistance cannot be measured and there are young patients who do well under early nephrectomy.

URETER

The condition of the ureter is not given in a large number of the cases of this series. The kidney condition apparently occupied the entire field of vision of the surgeon. The condition of the ureter was not mentioned in 52 of the cases. In 18 it is recorded as thickened while there were no cases in which a normal ureter was reported. In our later cases in which special emphasis was placed on the condition of the ureter we have been unable to find a single case in which definite tubercle formation was not demonstrated where enough of the ureter was examined. In one case with a single lesion of the upper pole of the kidney and in which the duration of bladder symptoms was short there was but one tubercle found in an otherwise apparently normal ureter.

There is no evidence of any examination of the ureter for stricture.

ANOMALIES OF THE KIDNEY

Harbitz and others have pointed out the occurrence of tuberculosis in abnormal developments of the kidney. We have found no anomalies of the kidney in this series.

END-RESULTS

Immediate mortality. Of the 103 cases operated on during the period covered in this review, there were four deaths taking place in the hospital as a result of operation. This gives an immediate mortality of 3.8 per cent. In comparing this result with that of other observers, it must be remembered that in some reports, immediate mortality is made to include those deaths taking place within the first 3 or even 6 months after operation. Immediate mortality is properly considered to be death as the result of operation and taking place in the hospital where the patient is under observation. This, I believe, is now the accepted interpretation.

The cause of death in the 4 cases was as follows: One patient died the seventh day after operation of pneumonia (necropsy obtained). One patient died the eleventh day of pyelonephritis of the lone kidney (necropsy). Two patients died immediately of hæmorrhage and shock, both being in poor condition at time of operation, one having had secondary infection of the tuberculous kidney.

Immediate mortality has improved with better diagnosis and operative technique.

Brodeur up to 1890 had 58 per cent mortality in nephrectomy for tuberculosis, Palet up to 1893 had 40 per cent, Pousson up to 1902, had 28.4 per cent.

In comparison with this the mortality of Albarran, Barth, Caspar, Cathelin, Czerny, Dollinger, von Frisch, von Illyes, Israel, König, Kronlein, Kuster, Nicolich, Pousson, Rafin, Reczey, Rovsing, Rotter, Schede, Tuffier, Wildbolz, and Zuckerkandl in the years 1902 to 1908 for 847 cases operated was 11.1 per cent. Wildbolz reports his immediate mortality for the years 1902 to 1914 for 139 cases at 2.8 per cent. Asakura for the years 1905 to 1910 had 5.7 per cent of deaths. Israel's collection of 1,023 cases reported in 1911 had a mortality of 12.9 per cent. Von Frisch reported in 1911 a series of 100 nephrectomies with a 10 per cent mortality. Braasch in 1912 reported 203 nephrectomies with a mortality in the hospital of 2.9 per cent.

It seems safe to expect that in the hands of good surgeons at the present time immediate mortality will be below 5 per cent.

CAUSES OF DEATH IN EARLY MORTALITY

The causes of death in the course of convalescence after nephrectomy for tuberculosis in a collection of cases reported from various clinics show that the commonest factor is pneumonia, the second in frequency "shock" Ether is the anæsthetic in the cases of death reported from pneumonia in which the anæsthetic is mentioned. The common causes of death immediately after nephrectomy are as follows:

Pneumonia

Shock

Hæmorrhage at the time of operation

Secondary hæmorrhage

Reflex anuria with uræmia.

Acute nephritis in the remaining kidney

Cardiac failure.

Necrosis of the small intestine in right-sided operation

Trauma to the colon

Endocarditis

Miliary tuberculosis

Thrombosis of the renal vein of the opposite side

Pyelonephritis of the remaining kidney

The absence of embolism as a cause of death after nephrectomy for tuberculosis is noteworthy. One would expect it to be of frequent occurrence in an operative procedure in which extensive manipulation of the kidney is necessary before the vessels can be ligated. I have not found recorded in the literature any case of death due to this cause.

LATE MORTALITY

Late mortality is defined as death from tuberculosis subsequent to temporary recovery from the operation. Fourteen of the cases of this series (20 per cent) are known to have died from tuberculosis. One patient on whom a nephrectomy was done for tuberculosis of the kidney, while not yet free from bladder symptoms 5 years after operation, was discovered to have carcinoma of the uterus from which she died 2 years later. This death is not reckoned in the late mortality. Of the late deaths from tuberculosis the assigned causes are as follows.

Four died within three months from tuberculous cachexia.

Three died from genito urinary tuberculosis and exhaustion; one in the third year and two in the second.

Two died, one in the first year and one in the fourth, of tuberculous meningitis.

Five died at an average of 3.2 years after nephrectomy. In all these cases the death certificate is signed "tuberculosis." Half of the 14 cases died during the first year, the other half at an average of 3.3 years, only one lived more than 5 years.

From a compilation of data from 2,000 cases in which the cause of death in late deaths is given, the commonest causes in the order of their occurrence are general tuberculosis, lung tuberculosis, tuberculous meningitis, and miliary tuberculosis. Both meningitis and miliary tuberculosis are more frequently met with in genito urinary tuberculosis than in other forms of disease.

WOUND HEALING

Of the 70 cases no data could be obtained in regard to the healing of the wound in 17. Of the remaining 53 cases seen at some time during their convalescence, 75 per cent had sinuses of more than 2 months' duration or had abscesses develop at some later time after the wound had closed, while 25 per cent healed by first intention and remained solid. Secondary sutures were done for persistent sinus in 3 instances, and these wounds healed quickly and remained solid.

It is interesting to compare the end result of the drained wounds of this series with that of our recent cases in which the wound was closed without drainage after injecting salt solution. In these later cases there were 25 per cent of the wounds which remained tight while 75 per cent developed abscesses. Abscess development was usually 3 to 5 weeks after leaving the hospital. This fact would have encouraged us to close all wounds without drainage had it not been our misfortune to follow the cases in the out patient department and see the final results.

EVIDENCE OF EXTENSION OF THE DISEASE AFTER NEPHRECTOMY

Thirteen new lesions occurring in 9 cases are recorded. They are as follows:

Tuberculosis of the epididymis	5
Active pulmonary tuberculosis	3
Tuberculosis of the prostate and vesicles	2
Tuberculosis of the larynx	1
Tuberculosis of the remaining kidney	1
Tuberculous stricture of the urethra	1

These cases, save one in whom all tuberculous processes are now apparently arrested after epididymectomy, are included among the dead or unimproved.

Genital lesions in males The occurrence of lesions of the epididymis either before or after nephrectomy was noted in 11 cases

Epididymitis on the same side as the kidney	4
Epididymitis on the opposite side from the kidney	2
Bilateral	3
Side not mentioned	1

Eleven of the 34 males, or 32.3 per cent, developed epididymitis either before or after operation.

There were no instances in this series of tuberculosis of the fallopian tubes in the female.

SYMPTOMS OF PATIENTS NOW LIVING

Frequency is still a complaint in 24 cases. In 4 of these patients the urine contained no albumin, negative sediment, and no growth in culture. The condition was demonstrated to be due to contracted bladder, the size of the bladder varying from 2 to 5 ounces. In the great majority of the cases frequency had greatly improved by the end of 2 years. Some improvement in the contracted bladders followed mechanical dilatation, but in none was the condition cured.

The great majority of cases in which there was little or no improvement at the end of 2 years continued to have troublesome symptoms indefinitely. Few patients have made noteworthy improvement after 4 years.

ALBUMIN

Sixteen cases showed no albumin or abnormal sediment. Twenty-five cases showed albumin in small traces. In 4 the albumin was in large amount. One of the four had much pus with casts and the other three had casts alone. One of the latter had casts previous to operation. In 6 cases no urine specimens were obtained. Seven cases complained of no urinary trouble yet the sediment showed microscopic pus and there was a trace of albumin. Closer inquiry revealed

that the patients had nocturia and some frequency to which they had become accustomed.

The presence of small amounts of albumin and pus in the urine is not evidence of persistent active secondary lesions. The condition is obscure and cystoscopic and cultural evidence as well as guinea-pig inoculation show no cause for the urinary condition. These cases are properly considered cured of tuberculosis but are not free from the effects of the disease which has resulted in permanent damage to the genito urinary tract.

In 3 cases, with no bladder symptoms, there was a growth of bacillus coli and the sediment showed pus.

WEIGHT

All cases report either a temporary or permanent gain in weight and improvement in general health. Forty-four now weigh an average of 23 pounds above the pre-operative weight. The great majority have maintained the greater part of their gain. The largest gain is that of a woman who weighed 78 pounds at the time of operation and who now weighs 156½ pounds. Gain in weight followed by loss of weight with the pre-ent weight below that at the time of operation is noted in but 3 cases. These cases are numbered among the unimproved and have positive guinea pigs.

One case, a woman of 45 years, was seen 18 years after operation. She had no symptoms after two years save slight frequency. Her urine is negative as is also the guinea pig inoculated from bladder urine. She has gained 55 pounds, has been married 10 years, has had 3 normal pregnancies, and pneumonia, typhoid, and scarlet fever. She is strong and well save for a little frequency due to a contracted bladder. Her bladder holds 5 ounces and resists attempts at dilatation. She finds it necessary to void every 2½ hours as she has acquired the water drinking habit and has a small bladder.

HERNIA IN SCAR

Was present in one case but was small and not sufficiently troublesome to demand interference.

GUINEA-PIG INOCULATION

Was done in all cases where the patient sent a specimen of urine or was seen in person. In 6 instances the guinea pig was positive.

CURED

We have classified as "cured" those patients in good general physical condition, with maintained gain in weight, without evidence of extension of the disease or if new foci have developed they are now quiescent, with improvement of bladder symptoms and no evidence of active lesions in the genito-urinary tract. Sixty per cent of the cases in the series conform to these requirements.

UNIMPROVED

The term "unimproved" is applied to those patients who may or may not have maintained their post-operative gain in weight, whose general physical condition is below normal, who still have active secondary lesions of the genito-urinary tract or in whom the disease has progressed and the new lesions are active and in whom nephrectomy has not afforded the expected retardation of the disease, 12.8 per cent of the cases are unimproved.

MENINGITIS IN GENITO-URINARY TUBERCULOSIS

Israel Simmonds, and Muller have produced evidence to show that the incidence of meningitis in tuberculosis of the genito-urinary tract is greater than in other forms of the disease. Israel states that 12 per cent of the cases operated upon for renal tuberculosis die of meningitis. Simmonds examined 60 cases of genital tuberculosis as to the cause of death and found that 19 (30 per cent) had died from tuberculous meningitis while there were only 5 per cent of deaths from this cause in lung tuberculosis. Muller examined in the Vienna General Hospital for a period of ten years, cases in which the cause of death was tuberculosis to ascertain the frequency of meningitis. He studied 5372 cases and found that 223 died of meningitis, which gives 4 per cent of all deaths in tuberculosis due to meningitis alone. There were 723 cases of tuberculosis of the urinary tract alone and 77 of the genital tract alone, with

13 deaths among these from meningitis (1.6 per cent). There were 105 cases of tuberculosis of the genito-urinary tract, with 23 deaths or 22.5 per cent of all deaths in the combined form of the disease. Deaths from this cause are usually remote from the operation.

CONCLUSIONS

1 Young individuals with early lesions of the kidney which usually show considerable cortical tuberculosis and perinephritis do less well after nephrectomy than those of more advanced age in whom, however, the disease is often more extensive. The reason appears to be the extent of acquired immunity.

The practicability of artificial immunization of these individuals demands consideration.

2 Male patients offer more difficult problems in treatment than female and the prognosis is less favorable. Genital lesions are uncommon in the female while 32 per cent of the male cases of this series show genital involvement.

3 Immediate mortality for this series is 3.8 per cent. The operation of nephrectomy for tuberculosis is not serious as regards death of the patient. The immediate mortality is that consequent to pneumonia, shock, and accident and should not exceed 5 per cent in unilateral lesions.

4 Late mortality for this series is 20 per cent. A late mortality of 15 to 20 per cent should be expected, about 50 per cent of the deaths taking place within the first 2 years, and the remaining 50 per cent before 5 years where the lesion is unilateral.

5 Sixty per cent of our cases can be considered cured. Somewhere between 55 to 70 per cent of the cases operated upon for unilateral lesions can be considered cured of active tuberculous lesions at the end of 5 years. There remain, however, in about 35 per cent of the cases legacies of the disease in abnormal urine and persistent symptoms. Nephritis probably of toxic origin and secondary infections of the remaining kidney; irritable bladders sometimes due to cicatrices, traces of albumin and slight pyuria are among the commonest permanent effects of the disease.

6 In 10 to 15 per cent of the cases the progress of the disease will not be checked by nephrectomy. There were 9 cases (12.8 per cent) unimproved by operation in this series.

7. The results for this series of drainage of the wound after nephrectomy compare favorably with undrained wounds in our recent

cases in regard to sinus formation. There is approximately 25 per cent which heal by first intention and 75 per cent in which sinuses develop irrespective of the method of wound closure employed. In undrained wounds sinus development is late and where the follow-up system is not carried out may give a false idea of the value of the treatment.

NEPHRECTOMY DURING PREGNANCY¹

By LOUIS E. SCHMIDT, M.D., F.A.C.S., CHICAGO

OPERATIONS during the course of pregnancy are common. Operative interference even in the uterus and in the adnexa as well is not unusual. I wish to discuss particularly the removal of a kidney during pregnancy. There are many interesting features bearing on this subject which are worthy of consideration. The question was brought forcibly to my attention in March, 1913, when a patient presented herself with the following history:

Patient No. 60,599, Michael Reese Hospital, referred by Dr. H. Banga. M. W., age 28. Knows of no serious illness. Has had four children, the youngest being 14 months. All deliveries were normal and easy. She has not menstruated since last birth, before which the periods were irregular, 6 and 7 weeks, lasting 4 and 6 days, always accompanied by slight pain.

Present complaint. Possibly last labor was followed by a slight temperature. Eleven months ago frequent and painful urination commenced. Now she passes urine five and six times each night and every half hour during the day. The urine is often bloody with clots and frequently milky and thick. She has not been able to sleep, has complained of considerable pain in the lower abdomen, and of late the pain at end of urination has become unbearable. She believes she has had slight chills followed by fever. The last few months she has become weaker and unable to attend to the slightest work. She has been practically unable to eat and badly constipated.

Examination. Temperature previous to operation ranging from 99° to 101° F. White blood count from 8,000 to 15,000. Blood pressure 105. Hemoglobin 60 per cent. Urine, large quantity of pus, blood-corpuscles, microscopically, red blood corpuscles were always present. There were no

casts but a large number of epithelial cells. Bacteriologically, colon bacillus was demonstrated, and bacillus tuberculosis was found repeatedly in stained specimens. Physically the patient was greatly emaciated and weighed 108 pounds. Her skin was dry and swarthy. Her heart and lungs were negative. The abdomen indicated a pregnancy of about the end of the fifth month. Palpation of left kidney showed that it was much enlarged and sensitive. The right side was negative.

Cystoscopic examination. Bladder mucosa congested. Left ureteral catheterization revealed obstruction at 2.5 cm from orifice. The obstruction could not be passed and no urine was collected. Right ureter catheterized and catheter easily passed to pelvis. The urine on this side showed no abnormal elements. A phenolsulphonephthalein test gave on left side appearance in 4.5 minutes, 17 per cent first 15 minutes and 10 per cent second 15 minutes. No dye could be detected on left side. X-ray examination showed much enlarged kidney as well as ureter. The right side was negative.

Operation, May 22, 1913. Incision from tip of last rib on left side extending outward and downward toward the spine of the pubes. The kidney and ureter were exposed. Both were markedly adherent to all surrounding parts. The ureter was tied off below the obstruction, the vessels to the kidney were separately ligated, and the fatty capsule with kidney and ureter were removed *en masse*. The wound was closed, except for drainage at both ends of incision. After operation the temperature rose to 105° F., following slight chill. Otherwise there were no untoward symptoms. The patient made a slow recovery. At the lower angle drainage persisted until following childbirth.

On September 11, 1913, Dr. Simon attended normal delivery. The baby died twelve days later of sepsis. The mother was discharged from the hospital in January 1914.

Pathological report made by Dr. Kirk of Michael Reese Hospital. On gross examination, the kidney

¹Read before the American Association of Genito-Urinary Surgeons, White Sulphur Springs, West Virginia, May 18-20, 1913.

is slightly larger than normal, measuring 12 cm from pole to pole. It weighs 270 grams. The surface is irregular and nodular, and the capsule is thickened. The ureter is attached. It is considerably thickened, congested, and inflamed. The distal 3 cm. of the ureter is hard, firm, resistant. On cut section, made by incising the kidney longitudinally, there are four large pus cavities measuring 2 to 4 cm in diameter, two at each pole. These are filled with a caseous material of the consistency of putty, upon the removal of which ragged-walled cavities are left. About the cavities there is an increase in the connective tissue.

Diagnosis: Tuberculosis of the kidney, pyonephrosis ureteritis.

In looking through the literature I find that Hartmann in *Traite de Chirurgie* 1913, refers to 30 cases, in which nephrectomy was performed during pregnancy. I have found five more cases and have included them all in the series of cases reported at the end of this article. The following facts were deduced from a study of the cases:

1. Total number of cases 35

2. Mortality mother 2 cases, 5.7 per cent

3. In seven cases the effect on pregnancy is not indicated. In one case the operation was done almost at the time of delivery and spontaneous birth with living child occurred. Of the remaining cases 21, 77 per cent, had normal labors at term. Three had spontaneous abortion, one had induced abortion, one had induced labor, one had dead fetus extracted.

4. In only four cases, 15 per cent, it is stated positively that harmful effects on the fetus occurred.

5. As regards the time of the operation:

In the second month of pregnancy	4 cases
In the third month of pregnancy	6 cases
In the fourth month of pregnancy	8 cases
In the fifth month of pregnancy	7 cases
In the sixth month of pregnancy	4 cases
In the eighth month of pregnancy	2 cases
Not definitely stated	4 cases

Even since the first nephrectomies have been carried out it has been satisfactorily demonstrated, and more convincingly every year that the remaining kidney compensates for the loss of its mate becomes hypertrophied, and answers every purpose of the individual.

There is in connection with this subject another angle of equal, if not greater, import-

ance, namely, that a great number of women on whom a kidney has been removed for one cause or another later become pregnant. From the literature as well as from personal observation, I am inclined to believe that, if pregnancy occurs not too soon after nephrectomy, it is not hazardous provided the remaining kidney is not diseased. However, if the remaining kidney is diseased and not functioning properly it is dangerous to mother and child. To illustrate, if nephrectomy has been performed in a patient suffering from congenital cystic kidney, in which cases it is a fairly well established fact that the opposite kidney is always of the same type, pregnancy certainly is detrimental to the mother and forbodes abortion or death to the fetus. In case of pregnancy following nephrectomy for tuberculosis, provided there is no tuberculosis of the bladder or ureter, or for stone and infection, no harm can result. Marriage should not be sanctioned where disease of the bladder such as tuberculosis, is present, or if the remaining kidney is diseased.

I can recall several instances where pregnancy went to term following nephrectomy, without detriment to mother and child. When we consider that the kidneys are frequently involved during pregnancy and that degenerative changes and various types of nephritis as well as pyelitis and pyelonephritis make their appearance at such times it will be understood that during pregnancy the kidneys are unquestionably put to a severe test and for some reason easily become involved. Therefore after pregnancy a woman in health must be kept under careful observation and to some extent as Tietze and others have pointed out a woman with only one kidney runs a greater risk. But to remove a kidney during the course of pregnancy and throw all the work on to one is undoubtedly a greater strain on the functional capacity than in the mentioned instances. Therefore I believe that it must be carefully considered whether or not a nephrectomy during the course of pregnancy is to be advised. It has been shown that toward the end of pregnancy the combined nitrogen is increased unquestionably indicating that greater demands are made on the

healthy kidneys. Particularly toward the last month of pregnancy albumin, with or without the presence of casts, is frequently noticed. There is a slight difference in percentage as regards primipara and multipara. These cases can and often are freed from albumin and casts by either diet or normal termination of pregnancy.

There is, however, a far more grave type of albuminuria which is accompanied by nausea, vomiting, œdema, and other signs and symptoms, and which necessitates the interruption of pregnancy in order to save the life of the mother. Oftentimes spontaneous abortion occurs. In contradistinction to the other form, this type continues even if the mother recovers. In both instances it is pregnancy, the product of pregnancy, or a toxæmia which is the cause.

Therefore, to do a nephrectomy during the course of a pregnancy involves the question whether in cases in which a diseased kidney has already influenced its mate the great problem of eclampsia will not appear. I believe that it is now the general opinion, that in the vast majority of instances of eclampsia a chronic disease of the kidney exists before pregnancy. In recent years the literature has teemed with the problem of the infections—I have particular reference to pyelitis and pyelonephritis. I do not wish to discuss the mode of access. Suffice it to state that these conditions are not at all uncommon. It must be admitted that either one or all of the aforementioned conditions are frequent occurrences whether the woman be free from all kidney disease or even if a chronic disease of the kidney exists before pregnancy. Naturally if a woman has only one kidney, it is a matter of greater import and it follows that if a nephrectomy is carried out during pregnancy, not only the above facts must be considered, but the sudden transference of all work to the remaining kidney adds greatly to the problem. I might state that if the remaining kidney is diseased the problem is still of greater import to both mother and child.

I can still recall the time when the consent of the obstetrician to marriage was grudgingly given in those cases where it was

known that one kidney had been removed for one cause or another. I do not wish to pass over this subject too lightly, but I believe that I have pointed out some facts which must be taken into consideration, which, however, are appreciated more keenly than formerly. It is needless to state that there are many authorities that still hesitate in giving their consent to marriage under such circumstances. One must consider undoubtedly the cause for which the nephrectomy was carried out. With all our modern diagnostic methods at hand it is certain that one is in a much better position to judge correctly than a decade ago. This question as well as the one under consideration is intertwined with the same problems and hence I have taken the opportunity to express my views on both. I have collected in all 36 cases including my own and have already mentioned some of the more important facts. I do not wish to go into the details as to the methods of diagnosis employed nor the question of the examination of the functional capacity of the kidneys nor of the course of the patient after termination of pregnancy for the simple reason that the cases recorded are not uniformly reported. However my impression is that whenever conditions are present before pregnancy which demand nephrectomy, it is more desirable to remove the kidney before impregnation than to be obliged to carry out nephrectomy during pregnancy.

From the literature as well as from personal observation, I have come to the conclusion that a woman with one healthy kidney, and that implies that no infection remains whether it be tuberculosis or a pyogenic infection, does not carry much greater risk, nor does the fetus, than the more fortunate woman who has two kidneys, and that consent to marriage and pregnancy cannot be withheld. There are questions such as how soon after nephrectomy may one, without danger, become pregnant. I am of the belief that if a period of several years of complete absence of kidney disease elapses it is safe. There is a greater need for exact observation of these cases, so that in case of the recurrence of any (nephritic) symptoms, induced abortion or labor can be carried out in order to prevent

chronic kidney changes which might result in making an invalid of a woman having only one kidney

The following is a series of cases in which nephrectomy was performed during pregnancy

CASE 1 Reported by Andrews in the *Journal of Obstetrics and Gynecology of the British Empire*, 1909, xvi, 249 The patient, aged 28, a multipara, four months pregnant, was operated upon for movable kidney and hydronephrosis—nephrectomy, recovery Four years later she was operated upon by the same surgeon for unilocular cyst The patient went to term without complications and has had five subsequent pregnancies

CASE 2 Reported by Bickel in the *Indian Medical Record* February 21, 1900, p 172 The patient a multipara, aged 29 was in the third month of pregnancy, when she was operated upon for hydronephrosis Her recovery was delayed by a febrile dermatitis, but she was in perfect condition five months after operation She went to term without complications, and labor was normal

CASE 3 Reported by Braatz in the *Deutsche Zeitschrift für Chirurgie*, vol xlviii The patient, aged 33, was in the eighth month of pregnancy She was suffering from an epithelial tumor of the kidney pelvis, with complications A nephrectomy was done, and the patient left the hospital in good condition Pregnancy apparently went to term but there are no particulars given by the author

CASE 4 Reported by Brown in the *New York Medical Journal* of August 16, 1890 The patient, a multipara aged 26, in the second month of pregnancy, suffered from chronic pyelitis with severe hamaturia simulating calculus for which nephrotomy and nephrectomy were done The patient recovered but aborted on the ninth day after operation

CASE 5 Reported by Coxa in the *Annals of Obstetrics*, 1903 xxv 694 The patient, a multipara aged 35 in the third month of pregnancy, suffered from calculus and cystic kidney Nephrectomy was performed and she left the hospital after six weeks in good condition Pregnancy proceeded to term without complications and a healthy child was born The patient subsequently became pregnant, with normal labor and lactation

CASE 6 Reported by Cragin in the *American Journal of Obstetrics*, 1898 xxxiv, 36 The patient, a multipara, aged 25, was eight and one half months pregnant She had an ectopic kidney blocking the pelvis, and hydronephrosis Nephrectomy was done per vaginam The patient recovered The day following the operation labor started spontaneously and a healthy, living child was born

CASE 7 Reported by Cumston in the *New York Medical Journal* in 1902 The patient a multipara aged 29, was in the fourth month of pregnancy

She suffered from pyelonephritis for which nephrectomy following nephrotomy was done The patient recovered three weeks after the operation She went to term without interruptions, and the child was born in good condition, without complications, at term

CASE 8 Reported by Dobson, in the *British Medical Journal*, April 15, 1911 The patient, in the fifth month of pregnancy suffered from multiple abscesses of the kidney Nephrectomy was done and the patient recovered The effects of the operation on the pregnancy are not stated, but apparently labor proceeded to term, uninterupted

CASE 9 Reported by Gerster in the *New Yorker medizinische Monatsschrift*, 1897 The patient, a multipara, aged 26, was in the sixth month of pregnancy She suffered from an echinococcus cyst of the kidney, for which nephrotomy followed by nephrectomy was done She recovered, but aborted a month after the operation

CASE 10 Reported by Haringau in the *American Journal of Obstetrics*, 1914, lxxx, 500 The patient, aged 21, was in the fourth month of pregnancy She suffered from an acute infection of the kidney, for which nephrectomy was done She recovered. The patient was delivered by induced labor and both mother and child are well

CASE 11 Reported by Hartmann in *Travaux de chirurgie*, fourth series, 1913, p 455 The patient, a multipara, aged 34, was in the second month of pregnancy, when nephrectomy was performed for pyonephrosis She recovered and went to term without any complications She has had two subsequent normal pregnancies

CASE 12 Reported by Hartmann (Pillet) in *Travaux de chirurgie*, fourth series, 1913 p 455 The patient, a multipara, aged 23, in the sixth month of pregnancy, was suffering from renal tuberculosis, for which nephro-ureterectomy was done The patient left the hospital in good condition twenty days after the operation She was delivered of a living, healthy child, at term She had some slight vesical symptoms still, six months later

CASE 13 Reported by Helferich in *Thesis of Blanc* (Paris), 1908, p 74 Nephrectomy was done for pyonephrosis and the patient recovered She went to term and was delivered of a healthy child

CASE 14 Reported by Israel in the *Berliner klinische Wochenschrift*, 1897, xxxiv 104 The patient, aged 20, primipara, was in the fifth month of pregnancy Nephrectomy was performed for pyonephrosis and the patient recovered Pregnancy proceeded to term without interruptions

CASE 15 Reported by Israel in the *Archiv für klinische Chirurgie* 1894 xlviii 302 The patient, aged 20, in the fourth month of pregnancy, was operated upon for renal tuberculosis—nephrectomy, with recovery Labor proceeded to term without disturbances and a healthy child was born

CASE 16 Reported by Jarman, in the *Annales de gynécologie et pédiatrique*, 1900, xiii, 662 The patient, aged 31, a multipara, was in the fifth month of pregnancy, when she was operated upon (nephrectomy) for tumor of the kidney She recovered, and pregnancy proceeded to term without complications, and she was delivered of a living child

CASE 17. Reported by Kosinski in the *Medycyna*, 1893, No. 40, and *Centralblatt für Chirurgie*, 1893, xx, No 51 The patient was four months pregnant when nephrectomy was done She recovered and pregnancy proceeded to term without interruption

CASE 18. Reported by Kronlein in the *Verhandlungen der deutschen Gesellschaft für Chirurgie* xxviii The patient, aged 38, was in the third month of pregnancy, when nephrectomy for multilocular cystic kidney was done The recovery was perfect, but the effects on the pregnancy are not given

CASE 19 Reported by Landau in the *Deutsche medizinische Wochenschrift*, 1893, xix 560 The patient was in the second month of pregnancy when nephrectomy was performed for kidney calculus She recovered but the effects of the operation on the pregnancy are not given

CASE 20. Reported by Lenger, in *Presse Médicale* 1896, ci, 607 The patient, aged 29, primipara in the sixth month of pregnancy, was operated upon (nephrectomy) for hydronephrosis Eclampsia started the day after the operation, and the patient died on the third day after operation A dead fetus was extracted

CASE 21 Reported by Zohmer, *Dissertation Griefswald* The patient aged 37, multipara, in the fifth month of pregnancy was operated upon (nephrectomy and nephrectomy) for pyonephrosis She recovered, the pregnancy was not interrupted and a healthy, well developed child was born

CASE 22 Reported by Legneux, *Bulletin et mémoires de la Société d'obstétrique et gynécologique de Paris*, May 1904 The patient aged 27 multipara two and one half months pregnant was nephrectomized for kidney abscess She recovered but suffered from tuberculous pleurisy some months later from which she recovered The pregnancy continued normally and a healthy child was born in the hospital, at term

CASE 23 Reported by Marx, *Prezgrad Leharski* 1901 (Quoted by Coon *Annales d'obstétrique* 1903, xxv, 698) The patient in the fifth month of pregnancy was operated on for tumor of the kidney She recovered The effect on pregnancy is not given, but apparently it proceeded normally to term

CASE 24 Reported by Mirabeau, *Archives für Gynäkologie*, 1907 lxxxii, 484 The patient aged 34, multipara, in the fifth month of pregnancy was operated upon for tuberculous kidney (nephrectomy) She recovered, went to term and a vigorous child was born without complications The patient continued in good health for several years after the operation

CASE 25 Reported by Martin, *Zeitschrift für Geburtshilfe*, 1890, xviii, 375 The patient, aged 22, length of pregnancy not definitely stated, was operated upon (nephrectomy) for movable kidney and hydronephrosis She recovered Apparently the pregnancy was not affected but the reporter does not state the facts in this regard

CASE 26 Case of Nicolich, reported by Hartmann in *Traiteaux de Chirurgie*, fourth series 1913, p 458 Particulars as to the age and length of pregnancy are not given The patient was operated upon for tuberculosis of the kidney—nephrectomy She recovered and labor was normal, at term

CASE 27 Reported by Parkes, *American Journal of the Medical Sciences*, September, 1890 c 264, CASE 23 The patient, aged 26 multipara in the fourth month of pregnancy, was nephrectomized for adenoma of the left kidney Recovery was complete in two months She went to term and a well developed child was born

CASE 28 Reported by Pilz, *Zentralblatt für Gynäkologie*, 1905, p 649 The patient, aged 27, in the fourth month of pregnancy, was nephrectomized for renal tuberculosis She recovered and pregnancy was not interrupted

CASE 29 Reported by Polk, *American Journal of Gynecology and Obstetrics*, 1898 xii 164 The patient, aged 35 multipara, in the fifth month of pregnancy was nephrectomized for hydronephrosis She recovered and labor was normal at term

CASE 30 Reported by Prochownick (quoted by Hartmann in *Traiteaux de Chirurgie* fourth series 1913, p 458) The particulars as to age and length of pregnancy not given Nephrectomy was performed for multilocular cyst of the kidney She recovered and labor was normal, at term

CASE 31 Reported by Rudolph *Dissertation Griefswald*, 1898 The particulars not given as to age and length of pregnancy Nephrectomy was performed for renal suppuration She recovered but the effect on the pregnancy is not given

CASE 32 Reported by Scudder *American Journal of the Medical Sciences*, 1893, cx 646 The patient, aged 22 primipara in the third month of pregnancy was nephrectomized for a carcinomatous tumor of the kidney She recovered went to term and a living child was born without complications

CASE 33 Reported by Tufner *Annales des maladies des organes génito-urinaires* 1892, x 413 The patient, aged 30, multipara in the third month of pregnancy, nephrectomized for severe traumatic kidney lesions and suppurative nephritis After fourteen days the patient suffered from phlegmasia, alba dolens and died two days later (due thrombosis) Fourteen days after the operation the patient aborted

CASE 34 Reported by Twynam, *British Medical Journal*, 1898, i, 423 The patient, aged 32, multipara, the third month of pregnancy, was nephrectomized for pyonephrosis She suffered a light

attack of uræmia which subsided and the patient recovered. Abortion was induced one month after operation, as complications were anticipated.

CASE 35 Reported by Walmar, *Dissertation, Halle, 1900*, p 16. The patient, aged 28, in the fourth month of pregnancy, was nephrectomized for hydronephrosis. She recovered, pregnancy was uninterrupted, and delivery normal.

CASE 36 Reported by Schmidt, before the American Association of Genito-Urinary Surgeons in 1915. The patient, aged 28, multipara, in the fifth month of pregnancy, was operated upon because of tuberculosis of the kidney and ureter and a uretero-nephrectomy was performed. She recovered, pregnancy was uninterrupted, delivery normal, but the child died 12 days later of sepsis.

A CASE OF DIETL'S CRISIS IN AN ANOMALOUS RIGHT KIDNEY ASSOCIATED WITH A LEFT PELVIC KIDNEY¹

By R. C. BRYAN, M.D., F.A.C.S., RICHMOND, VIRGINIA

BILATERAL congenital dystopia is relatively infrequent. Strube in *Virchow's Archives* of 1894 mentions but four cases. The following are the available reported cases.

Armstrong² reports the following case:

Male, age 45, native of Germany, admitted to Memphis City Hospital, October 11, 1886, in comatose condition who died in a few hours. The autopsy showed the upper border of right kidney upon twelfth rib its lower border extending below the crest of the ilium. The gland was normal in size, slightly movable and the blood vessels except of lower origin, were normal. The upper border of the left kidney rested on the first sacral vertebra, and the gland rested on the sacrum. The left renal artery arose at the bifurcation of the aorta and entered the anterior external surface of the kidney about its center. The pelvis of the kidney was imperfectly developed on the posterior surface and contained the ureter and vein. The sigmoid flexure of the colon passed over to the right side, and the rectum was on that side between the internal border of the kidney and the pelvis. Both kidneys were pale, chronic nephritis.

Dr. Lenzen Belck³ reports in extensive detail a case of dislocation of both kidneys as the result of a fall from a wagon wheel to the ground. The patient struck his back upon the hub of the wheel and the wagon tongue and fell from here to the ground, striking firmly on the buttocks. He noted a severe pain in the back at the time and became unconscious for 10 to 15 minutes. Subsequent developments showed traumatic right wandering kidney. The patient declined operative fixation. He left the hospital much improved June 30, 1894. In January, 1897, he developed chills and fever and pain in the abdomen and back, similar to the

symptoms he showed at the time of dislocation of the right kidney, only this time the pain was on the left side. In the interim the right mobile kidney had also given him trouble. Both kidneys were displaced downward to a considerable extent. The condition of the patient grew worse so rapidly that malignant disease of the left kidney was suspected. Surgical measures had again been refused. Death October 29, 1897. The writer is convinced that malignant disease of the left kidney had developed, but autopsy was also refused.

E. Meuschen,⁴ St. Petersburg, reports the following case:

During autopsy on a female, age 19, who had died from pernicious anemia, Meuschen found a bilateral renal dystopia. The left kidney as well as the right then lay normally. The left kidney lay immediately in front and to the left of the promontory and in front of the edge of the sacrum, continuous with the innominate line of the os ilium.

The lower pole of the left kidney reached into the small pelvis for 3 to 4 cm. The right kidney, somewhat longer and narrower lay entirely within the large pelvis, its lower pole just touching the prolongation of the linea innominata at the sacrum. Both kidneys were firmly imbedded in the surrounding tissues and were in no way connected with one another. The two kidneys were not normal in shape. The left kidney did not possess the oblong, bean shaped form but was more rounded; its upper portion was narrower and broadened out below. The narrow frontal diameter was wider than usual, while the long frontal diameter was shorter than normal. Measurement of the anterior surface of the kidney showed a length of 8 cm., width 5.75 cm., and 4 cm. thick. The left kidney had the appearance of a rounded disk. It looked more like a potato; it showed no lobulation. On the anterior surface, a trifle above the center, was found the hilus to which the vessels descended from above.

¹ Congenital deformity of kidney; anomalous location of both kidneys. St. Louis Courrier Med. 1887, 370, 595.

² Ein Fall von Dislocation beider Nieren nach Unfall. Nephroptosis traumatica. Monatschrift f. Urologie 1898, v. No. 7, 15, p. 209.

³ Ein Fall von beiderseitiger Nierendystopia. St. Petersburg med. Wochenschr. 1900, XLIV, No. 41, 537.

⁴ Read before the American Association of Genito-Urinary Surgeons, White Sulphur Springs, West Virginia, May 18-20, 1915.

terminating in a groove in the upper half of the kidney, while the ureter descended behind the artery and vein.

The right kidney looked more like a normal kidney, but was smaller, its thickness was in excess to the width and length in proportionate measure — it was 9.25 cm long, 4 to 4.5 cm wide, the lower pole being wider than the upper, and the thickness 3.5 cm. The right kidney did not lie so close to the spinal column as the left. The left ureter had thinner walls and a smaller lumen than the right.

The cadaver showed throughout decreased measurements in all the blood vessels. Accessory kidney blood vessels noted.

Bilateral dystopia of the kidneys, distinct hypoplasia of the kidneys, in size as well as development, increase and variation in blood-vessel supply. The kidneys were separate, in no way connected. The entire picture might be construed as a development inhibition, a restriction or absence of growth of the kidney along the wolffian body as described by Strube.

All the blood vessels of the body showed a lumen smaller than normal, and all the arteries were underdeveloped. The left common iliac artery passed behind the kidney shortly after its origin, entered the adiposa capsule posteriorly, and divided in the lower third of the hypogastric artery. The right common iliac artery proceeded normally downward, passing the lower pole of the kidney obliquely. The aorta gave off on its anterior surface, about 1 cm from the bifurcation, an artery for the left kidney. This left renal artery was a little smaller than a goose feather stem, and divided behind its origin into two branches. At the point where the upper branch came near the pole of the kidney it gave off a branch of about the same size which entered the parenchyma of the kidney at the upper pole. Both main branches disappeared into the hilus to the kidney. The lower branch was more median to the hilus and behind the ureter. These two branches had a left renal vein between them. Shortly in front of the point where the left renal artery divided into the two branches the vein emptied into the left iliac vein.

The right kidney received from the right lateral surface of the aorta, about 2 to 3 cm above the bifurcation, an upper right renal artery which, horizontally coursed to the hilus of the right kidney, where it divided into two branches, the upper branch supplying the upper part of the kidney, the lower the more central portion. From the right common iliac artery immediately below its origin, arose the right inferior renal artery which also coursed toward the kidney horizontally approaching the hilus, behind the ureter. It also divided into two branches in the hilus behind the ureter, one for the upper pole and one for the more central portion of the kidney. In the hilus two veins united which emptied into the inferior vena cava.

Both suprarenal bodies lay in normal position.

A research of the literature at his command revealed only four cases of bilateral dystopia reported by Strube¹ in which the lower poles were not united. These cases were reported by Martin St Ange,² Boyd,³ Poirier,⁴ and Potherat and Morderet.⁵

Karl Joseph⁶ studied the records of the past 20 years of the pathological Institut at Giessen and found among other dislocations or displacements of the kidney, one case of bilateral dystopia of the kidney.

Male, age 19, fell from wagon and sustained fracture of the base. At autopsy no kidneys were found at the normal site, nor did any arteries emanate from the aorta at this point. The suprarenals were present on both sides of the spinal column at normal level. They were about the size of a "mark." The caecum was not fixed, but was easily mobile, the vermiform appendix was unusually long, but showed no other pathological changes. Fixation of the colon began at upper pole of right kidney. The right kidney, 11 cm long, 4 cm wide, and almost as thick, rounded in shape, extended with its lower pole to the linea innominata. An artery emanated from 1.5 cm above the site of bifurcation of the aorta, opposite the origin of the mesenteric artery inferior, and after a course of 4 cm divided into three branches, all of which enter within the hilus of the kidney.

The left kidney, 9 cm long, 6 cm wide, 2 cm thick, lay partly in the small pelvis, partly on the left psoas muscle and linea innominata, the hilus was directed forward and to the right. This kidney received its blood supply from two arteries, one arising immediately above the bifurcation of the aorta and immediately dividing into two branches. One of these again subdivides and both branches enter the kidney at the lower pole, the other branch runs along a twisted open groove of the kidney and then winds around to the front where it enters the hilus of the kidney. The second artery arises from the origin of the left common iliac artery, this is the larger and main artery of the kidney, its course is at first downward, and at the lateral margin of the kidney divides into two branches, one of which enters at the lateral margin of the kidney, while the other enters the hilus of the kidney by a circuitous route. The course of the veins was not described.

In discussion Joseph states that Strube reports 4 cases and Graser mentions 12 such anomalies.

¹ Virchows Arch f path Anat etc Berl 1894 v 137

² Ann d sc nat ser 1 v 79

³ Med Chir Tr Lond 1841 25 v 6

⁴ Bull Soc anat de Par 1889

⁵ Bull Soc anat de Par 1889

⁶ Zur Kenntnis der congenitalen Lagenanomalien der Niere Dissertation Giessen 1910

Tenchini¹ cites the following case.

Cadaver of female, age 60, died from double pneumonia in 1886, showed both kidneys in the pelvis on both sides of the sacrum. They were in contact with the rectum behind and the uterus in front. The patient had never given any sign of kidney disturbance during life, and the organs were normal and in normal position, nor were there any anomalies of the skeleton. The suprarenal capsules appeared to be normal. The left kidney had a very large hilus, situated anteriorly. The right, on the other hand, followed the median line and the ureters (shorter than usual but otherwise normal) emptied into the bladder separately. The left kidney had a large single artery arising from the primary iliac artery about 1.5 cm from the terminal division of the aorta. After traveling for 7.5 cm it joined the kidney, following a serpentine course for about 3 cm and finally ending in the hilus. The right, on the other hand had two renal arteries, both much smaller than the left and both arising from the common iliac, one (the upper) near the origin, the other near its termination. The first descended for a distance of about 6 cm, then it divided into one branch which entered the upper part of the kidney, while the other, which was more serpentine and longer, crossed the anterior aspect of the corresponding vein and entered the hilus of the kidney. The second (inferior) arose from the primary iliac artery near the terminal portion, descended along the posterior aspect of the kidney and after a circuit of about 4 cm entered a deep groove in the parenchyma of the kidney, but terminated finally in the hilus.

The left kidney had two veins arising from the hilus. One was very large and about 1.1 cm long, the other was quite small, about 7 cm long and deeper. The two united and emptied into a common trunk about 1 cm long, which emptied into the common iliac vein.

The right kidney had two veins which were entirely separate. One arose from the hilus of the kidney and was about 1.5 cm long. The other right vein was much smaller and shorter. It followed the course of the inferior renal artery and emptied into the external iliac vein at the point where the latter united with the hypogastric.

Niclot and Heuyer² report the following

Soldier died from pneumonia. No kidney signs. Double renal ectopia was found at autopsy. The right kidney was in the small pelvis on a line with the sacrovertebral angle, the left kidney was at the same angle at its inferior border, and somewhat more vertical. A fibrous band of about 1 cm in thickness united the two kidneys. The length of this band was 1.5 cm.

The aorta was divided into the right and left

iliac artery 10 cm above the sacral promontory. At this same level the two common iliac veins, united by an anastomotic vein, formed the inferior vena cava. The right kidney was the shape of a triangle at its base, and flattened from in front backward. The hilus was situated anteriorly between the upper and middle portion. Just above the hilus was a lobule about the size of a small egg, with a groove in front. The renal artery, about 8 cm long, began in the aorta at the level of the two iliac arteries, it was bifurcated at the upper border of the kidney. One of the branches passed to the right of the hilus of the kidney into the lobule mentioned, the other branch penetrated into the kidney on the posterior surface of the lobule. The ureter was about 12 cm long and descended vertically into the bladder.

The left kidney was flattened anteroposteriorly. The hilus was on the anterior surface between the upper and middle third. There were three left renal arteries. The first arose from the aorta passed to the rear of the left kidney and then divided into two branches, one entering the posterior surface, the other passing around to the anterior surface near the hilus. The second renal artery arose from the same portion of the aorta as the first and entered the upper posterior surface of the kidney (upper pole). The third renal artery arose like the other two and entered into the kidney at the posterior surface of the inferior pole. There were also three renal veins. The first renal vein left the kidney by the hilus, passing around the left border and following the groove marked by the anterior branch of the renal artery No. 1, passing behind it and entering the left common iliac vein. Renal vein No. 2 left the kidney via the hilus, passed to the right and made a groove on the right side, which, with the groove on the opposite side, divided the kidney into two lobes. This second renal vein formed the upper part of the anastomotic vein spoken of, which united the left common iliac vein to the right common iliac vein. The renal vein No. 3 arose from the lower pole of the kidney from the posterior surface, near the origin of the third renal artery, and formed the inferior part of the anastomotic artery. The ureter was 15 cm long, descended vertically into the bladder without any curvature.

There was no testicular ectopia. The right kidney weighed 195 grams the left 210. The suprarenal capsules were in their place.

S. C. Plummer³ does not cite any cases of bilateral dystopia.

George Strubel⁴ refers to four cases in the literature. No personal cases of bilateral dystopia of the kidney. He states that the literature contains quite a number of cases

¹ Un cas d'ectopie rénale bilatérale congénitale chez un femme adulte. Arch. ital. de biol. Turin, 1888, 15, 6.

² Sur un cas d'ectopie rénale double congénitale. Bull. Soc. anat. de Par. 1903, 132, 354.

³ Dystopic kidney. Surg., Gynec. & Obstet. 1913, 25, 1.

⁴ Über congenitale Lage und Bildungswandlungen der Nieren. Arch. f. path. Anat. Berl. 1894, cxviii, 127.

of double dystopia where the kidneys were fused. He cites 28 bibliographic references and says that Martin St. Ange made autopsy on an infant that had died shortly after birth and found both kidneys in the small pelvis. They were not fused in any way.

R. Boyd.¹

Female, age 72, died of chronic disease of the brain and lungs. Autopsy showed renal capsules in usual position, on either side of the spine, immediately below the diaphragm. Right kidney situated in the right iliac fossa, below the caecum, partially concealed by the right ovary, which had a slight peritoneal attachment to it. The renal artery was given off from the right iliac, close to the aorta.

The left kidney was in the pelvis below the psoas muscle, resting on the sacrum and origin of the pyriform muscle. An artery which arose from the aorta at its bifurcation, in the situation of the middle sacral, entered the upper end of the kidney, another larger branch from the internal iliac artery entered the kidney in the usual position. The kidneys, ureters, and bladder were in healthy condition. The vagina was absent, also the uterus and fallopian tubes. The left ovary was diseased, being occupied by a fibrous tumor of an irregular globular shape, connected by a round ligament smaller than that on the right side.

In the discussion of congenital malpositions Robert Holmes Greene and Harlow Brooks² state, on p. 214, that congenital malpositions of one or both kidneys are not uncommonly seen. As a rule they have but little importance clinically, although in certain cases, as was noted by Osler, they may seriously complicate diagnosis. This is particularly true of pelvic kidneys when pregnancy occurs. In a case occurring in the service of the writers, both kidneys were congenitally misplaced in the pelvic cavity, acute nephritis with fatal uræmia followed a twin pregnancy. The woman had passed through a previous single pregnancy without trouble, but in the twin pregnancy the greatly enlarged uterus so compressed one of the misplaced organs as to produce actual strangulation and gangrene with acute nephritis of the other kidney. The condition was not suspected and was discovered only at autopsy.

Ernst Graser³ states that among 200 cases of congenital misplacement of the kidneys which he found in the literature, he has detailed information as to about 150. In 12 cases both kidneys were displaced downward, in 103 the left kidney 35 times; in one case both kidneys were on the left side, in 4 instances both kidneys were on the right side; in 22 the displaced kidney lay at the level of the promontory, 15 times it was entirely in the small pelvis, usually in the vicinity of the sacro-iliac synchondrosis. He does not state where he found references to the 12 bilateral cases of dystopia which he mentions. He merely says he found 12 cases in the literature.

Potherat and Morderet⁴ cite the following:

Female came to autopsy. Both kidneys rested in the lower part of the iliac fossa, along the superior strait of the pelvis. The kidney of the right side is largely destroyed by a cystic degeneration without any macroscopic changes in the ureter. The kidney of the left side is increased in size, probably due to compensatory hypertrophy, the ureter is healthy. The double displacement is congenital for two reasons: (1) The suprarenal capsules occupy their normal position and correspond to the usual kidney distance. (2) The kidneys receive their arteries from many sources. The right kidney receives two arteries of same volume, the upper arising from the aorta immediately below the superior mesenteric and passes behind the vena cava. The inferior artery arises 3 cm. above the iliac bifurcation, at the level of the inferior mesenteric, passing in front of the vena cava. The left kidney received three arteries, one large upper artery arising from the aorta below the superior mesenteric and at a point corresponding to the normal origin of the renal divides into two branches, an upper and lower. The first is subdivided into two rami which enter the upper half of the kidney in front, while the other also subdivided into two branches which pass behind the veins and enter the kidney behind at the hilus.

The second artery, which is also large, arises from the aorta about 1 cm. above the origin of the inferior mesenteric. It passes to the lower end of the kidney, passing behind the corresponding vein, in front of the ureter. The third, very small artery, arises from the aorta at the same level as the superior mesenteric, passes in front of the upper renal artery, in front of the corresponding renal veins, and enters the middle portion of the internal border of the kidney.

¹Malposition of the kidneys: absence of the vagina, uterus and fallopian tubes: disease of the left ovary. *Med. Chir. Tr.* Lond. 1841. xxiv. 187.

²Diseases of the Genito-Urinary Organs and the Kidney. Philadelphia and London, 1908. 2d ed. 605.

³Beitrag zur Pathologie und chirurgischen Therapie der Nierenkrankheiten. *Deutsch. Arch. f. klin. Med.* 1895. iv. 405.

⁴Ectopie congénitale des deux reins. *Bull. Soc. anat. de Par.* 1889. lxiv. 124.

The patient also presented an anomalous situation of a portion of the duodenum, being located in the inferior portion of the abdomen in front of the superior strait of the pelvis.

P. Poirier¹ examined the cadaver of an old female which showed bilateral renal dystopia.

The right kidney was situated in the posterior half of the iliac fossa of the same side. It had a normal volume. The hilus was in front. There was a large vein 7 cm. long left near the hilus which emptied into the vena cava near or at a point between the second and third vertebrae. No arterial vessel emanated from the hilus. . . . Six arterial branches from various directions entered the kidney parenchyma at different points of the periphery. The first of these branches arose from the aorta about 1 cm. above the bifurcation and emptied into the upper pole of the kidney. The three others arose in a bouquet formed near the angle of the aorta and right common iliac. They entered the posterior portion of the kidney. The fifth arose from the aorta in the angle of the bifurcation of the two iliaes. The sixth which was quite large, arose at the bifurcation of the common iliac. Of all these arteries only one was accompanied by a vein.

The left kidney, much lower than the right, was situated in the pelvic cavity near the median line, about 2 cm. from the body of the fifth lumbar vertebra. Like the other kidney it was slightly lobulated in shape. Its hilus was directly anterior with calyx and one large vein which entered the vena cava at the same point as the left common iliac vein. The kidney received four arteries. The highest arose from the aorta at its bifurcation. The second arose in the same bifurcation angle. The third arose from the bifurcation of the common iliac. The fourth, which had a diameter of 2 mm., arose from a common trunk to the ischium.

The ureters emptied into the bladder normally, the left was 19 cm., the right 24 cm. long. The urinary apparatus, aside from the dislocation of the kidneys appeared to be entirely normal. The genital apparatus was also normal with the exception of a few cysts in the ovary.

Octave Pasteau² reported a case as follows:

Female, age 50, right kidney situated as low down as the right iliac fossa, right lumbar fossa absent. Its inferior extremity was situated 3 cm. below the iliac crest. The kidney was surrounded by a very thick covering of sclerotic tissue which was with difficulty separated from the kidney capsule. The kidney was large, ovoid in shape. It was distended by a purulent fluid, and on incision revealed old pyelonephritic lesions. The right ureter was large, irregular, and filled with pus.

The left kidney was also displaced but situated higher up than the right. Its lower pole extended 2 cm. above the iliac crest. It was not distended. The blood-vessels of both kidneys arose from their normal level, but varied as to their length and course. The general course was downward and backward. The right renal artery was 10 cm. long, the vein 8 cm. The left renal vein from vorta to its opening into the upper border of the kidney measured 8 cm. Three and one half cm. from its origin arose a branch which passed to the lower border of the hilus and measured 5 cm.

He thinks the report of this case of interest because there existed a bilateral dystopia, not congenital in origin, but due to the anomalous origin and length of the vascular pedicle of both kidneys. He found a glandular mass in the pelvis surrounding the right ureter, coinciding with cancer of the cervix uteri.

Max Strater³ states that Cadore collected 74 cases of renal dystopia, most of which were observed at autopsy. Thirteen were right, 29 left, and 3 bilateral ectopias, the location not noted in the remainder. Of the 67 cases collected by Strater, ectopia occurred 34 times on the left, 19 times on the right, bilaterally in 2 cases, and supernumerary in 2 cases.

CASE 1. Reported by Werth (references not given). Female, age 22. Never menstruated, pain in abdomen at intervals of 3 weeks, radiating to back. External genitalia well developed. In place of vagina a blind six half centimeter deep. Rectal examination failed to reveal vagina, uterus, or adnexa. Instead the finger palpated bilaterally a tumor the size of a fist. Both bodies lay along side the promontory. The upper end could not be reached. Both bodies were slightly movable. The kidney could not be found in either right or left renal fossa. A diagnosis of double pelvic kidney was made. There also existed a bilateral ovarian hernia which was removed by operation by removal of ovaries. Of the tubes only the abdominal end existed. This ended blindly.

CASE 2. Fischer (Orvostudium 1901. Reviewed in *Zentralblatt für Gynäkologie*). Did laparotomy on 10 year old girl with defect of vagina for assumed unilateral hematometra. The tumor was recognized however to be both kidneys lying in the cul de sac of Douglas. The uterus was a rudimentary lacrima.

Says nothing further about bilateral dystopia. Discusses other forms of dystopia in extenso.

¹ *Ann. mal. des reins*. Bull. Soc. anat. de Par. 1889, 121, 436.

² *Ectopie rénale double avec pyélonéphrite droite*. Bull. Soc. anat. de Par. 1897, 122, 115.

³ *Beiträge zur Pathologie und Therapie der kongenitalen Nierendystopie*. Deutsche Zeitsch. f. Chir. 1900, 123, 11, 55.

Félix-Léon Cadore¹ in a monograph on congenital anomalies of the kidney cites 3 cases of bilateral ectopia kidney. One by Poirier, one by Potherat and Morderet, and a third case probably by Turner, 1861, of which he says merely:

Case of malformation and malposition of the kidneys, death from Bright's disease, abscess in the kidney and pericarditis.

Under Cruveilhier, 1884, he says as follows: "In a woman two kidneys were fused, both occupying the rear of the rectum, and encroached slightly on the superior strait."

In his incomplete or imperfect bibliography he renders 519 references. Makes no special mention of bilateral dystopia with the exception of the cases mentioned above.

To the above cases, the writer wishes to add the following:

Mr H L, 38, married, German, occupation tailor, Richmond, Virginia, referred by Dr S B Moon for investigation of apparent Dietl's crisis from which he had been suffering constantly for several years.

The family history was negative. He had had most of the minor diseases of childhood, but had never contracted typhoid fever, pneumonia, or any severe illness. The bowels were fairly regular, he had gonorrhea at the age of 25 which ran a mild course, so that he had not noticed anything about the act of urination in recent years which he considered unusual or out of the ordinary.

Examination showed him to be a thin man, height 5 feet 9 inches, weight 128 pounds, rather pale, with protruding belly and atonic muscles, evident visceroptosis. Heart negative. Lungs showed a slight bronchitis. Liver normal in size. The urinalysis on admission to Grace Hospital was 1,010, alkaline, occasional blood cells, moderate amount of pus, some large round cells, no casts. Blood count Leucocytosis of 7,600. Wassermann negative. Luetin test negative. Rectal examination showed a small prostate, and normal vesicles, no tumor could be felt, there were slight hemorrhoids, no varicocele. Stool No ova guaiac test negative. No kidney could be felt on the left side, and the right kidney wall could not be palpated on account of pain and right abdominal rigidity.

On the right side there was a long rectus incision which had been performed about 6 months previously. And in the right lumbar region a tumor could be easily outlined about the size of the palm of the hand, exquisitely tender and apparently the kidney. Investigation of the operation which had been performed upon him October 1, 1913, showed that while in great pain which had continued for about a week, he had been carried to a hospital where a most competent and efficient



Fig 1 Left pelvic kidney, position below the synchondrosis opposite the second and third sacral foramina, diminutive size, pelvic capacity about 2 ccm.

surgeon operated, finding a tense empyema of the gall bladder which was removed, along with an infected, subacute appendix. The dystopic kidney was recognized at the time of this operation and the surgeon attempted extraperitoneally to replace the organ in its normal bed, but on account of a profuse hemorrhage which started from a large plexus of veins in a centrally located pelvis, nothing could be done and the organ was left untouched. The urinalysis at the time of this operation was amber, clear, acid, no albumin, no sugar, few granular casts.

The patient made a good convalescence and left the hospital in 3 weeks only to have a return of the outbursts from which he had previously suffered, characterized by great pain in the upper abdomen, with occasional vomiting and slight temperature. These attacks persisted throughout the following 18 months with increasing frequency and severity and could only be controlled by large doses of morphine.

We decided that the right kidney was the cause of the outbursts of pain, but there was apparently no left kidney as three X-ray examinations of the left kidney region gave no shadow. On cystoscopy the ureteral meati were somewhat inflamed, the right being the more turgid. Both were normally located, the capacity of the bladder 10 ounces, but the ureteral catheter could be shoved only two inches up the left ureter when it was abruptly stopped.

Pyelography with 35 per cent cagentos showed the left kidney to be at the level of the sacro iliac notch, its pelvis of so small capacity (about 2 ccm) that it did not seem it could be of much excretory significance. At this juncture the patient complained of the examination and flatly refused a pyelography of the right side or moth ball test (see Fig 1).

The idea then revolved itself around the functioning capacity of the left kidney, which although

¹ Les anomalies congénitales du rein chez l'homme. Thèse de doct. Par 1903 No 144 p 202.



Fig 2 Anterior view of the right dysplastic kidney. Note central location of pelvis, flattened condition, and enlargement dimensions being $5\frac{1}{2} \times 3\frac{3}{4}$.

misplaced and diminutive, we hoped would take care of the body so that the right organ, if impossible to anchor in its normal bed, could be removed. It had been planned before operation that a right pyelostomy would be carried out. A phthalein test could then be given, the bladder urine representing the left side, and the pyelostomy drainage that of the right side. If the left excretion proved sufficient, the right kidney could be removed at a later time, as it did not seem justifiable to remove the right organ leaving only the diminutive, ectopic pelvic kidney to serve the body.

Under ether anaesthesia May 19, 1914, an incision was made running from a point below the tip of the ninth costal cartilage downward. The peritoneum was stripped up internally, and was found to be densely adherent to a large plexus of veins the size of the thumb, in the center of the organ, which was the pelvis of the kidney. A profuse hæmorrhage started when an attempt was made to tease the peritoneum away. The kidney was firmly anchored in its bed and could not be moved. No renal artery was observed, but an aberrant artery at the upper and inner pole about the size of a goose quill was apparently the only arterial supply the organ enjoyed. Nephrectomy was hurriedly performed on account of uncontrollable hæmorrhage.

The pathologic condition of the right kidney as reported by Dr S. B. Moon, pathologist to Grace Hospital, is herewith given (Fig 2).

"The right kidney is a symmetric flattened ovoid, its edges laterally placed its flat surface anterior and posterior. Length $5\frac{1}{2}$ inches width $3\frac{3}{4}$ inches,



Fig 3 Opened view, small pelvis communicating with the kidney by three narrow channels, one from the upper pole, one from the lower pole, and one from the middle position. There is no pelvis.

thickness $1\frac{1}{2}$ inches. The surface is smooth save for several slight convex projections, and the hilum is in the middle of the anterior flat surface. An aberrant artery, about $\frac{3}{8}$ inch internal diameter, enters the edge one inch internal to the upper pole.

"The ureter, whose wall is decidedly thickened, widens to form a pelvis of proportionally small size, which is pouched communicating with the kidney by only three narrow channels, or calices, one to the upper pole, one to the lower pole, and one to the middle portion.

"The pyramids and cortex are arranged in a more or less haphazard manner, several pyramids, at least, having no communication with the pelvis. The cortex is somewhat thin, the capsule normal, as are also the color and texture, except for several congested areas of inflammation.

"Histologically the kidney structure appears to have been normal both as to medulla and cortex. Some areas exhibit an inflammatory condition with round cell infiltration and cellular degeneration and desquamation. These areas are especially noticeable at the corticomedullary junction, around the blood vessels" (Fig 3).

It was an interesting feature in the consideration of this posited right kidney, whether the patient's sartorial occupation predisposed to the abdominal outbursts by the crouching abdominal flexion of his character of work, bringing on a pelvic glaucoma, or whether the dense adhesions to the peritoneum anteriorly restricted and choked the ureter, for he had noticed for several years past that rapid walking, lifting, or straining aggravated the outburst.

Following the operation the patient reacted slowly, 24½ ounces of urine being excreted in the succeeding 24 hours, which was 1.020 acid, no blood, no albumin, small amount of pus, a great many uric acid crystals, no casts, a few large round cells. Remarks Less pus than before operation.

Urinalysis June 11, 1914 Acid, 1.008, no albumin, greatly diminished phosphates, excessive amount of indican, occasional red blood cells, large amount of pus, no crystals, no casts, few cells from bladder.

June 12, 1914, the patient left the hospital having had an uneventful convalescence, freedom from his attacks of pain, and declaring that he felt better than he had in several years.

May 1, 1915 The patient has been at work since the fall, has occasional attacks of abdominal discomfort, but none of the severe outbursts which he formerly had. He thinks that attacks of indigestion bring on the pain. He drinks freely of water and voids about every two hours by day, getting up twice at night something that he never had to do before the operation. The urinalysis shows acid 1.020 no albumin, no sugar no blood, pus, or crystals, no casts no excessive mucus. The patient takes no opiate and has increased somewhat in weight.

With the development of pyelography X ray, cystoscopy and ureteral catheterization, distorted states of the genito-urinary system are more frequently observed now than in former years an anomalous state of the kidney being observed about once in every 25 cases, for anomalous conditions of the genito urinary system are not uncommon, they occur more frequently than in any other structure of the body.

Nor is this hard to explain when we bear in mind the complex embryological development of the urogenital system.

Etiology In early life the cloaca is both the future rectum and bladder. A vertical fold separates the bladder anteriorly from the rectum posteriorly. The wolffian duct gains the cloaca dorsally and ultimately forms the renal pelvis and ureter. The kidney slowly ascends to the lumbar region, in the process of fetal evolution and development, receiving in its excursion arterial twigs which are given off from successively higher points on the aorta, as the kidney reaches higher, these twigs atrophy drop off and new arteries supplant them. The artery which continues as the renal artery is the last stem claimed by the kidney.

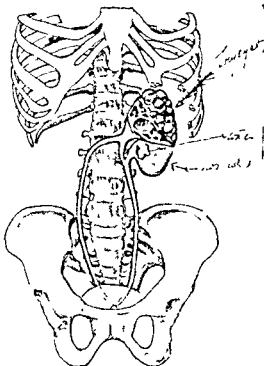


Fig 4. An anomalous right kidney (no kidney found on the left side) with the right ureter coming from the upper half of the pelvis the upper pelvis communicating with the lower pelvis and left ureter a stone present in the pelvis with the upper two thirds of the kidney polycystic and the lower third normal kidney tissue J W Vander Veer's case

In anomalous dystopic states the arterial feed to the kidney may come from along the course of the aorta, or from any of its subdivisions on the corresponding side, from the bony pelvis below to the diaphragm above. The case of trans-plantation of the kidney in the anterior abdominal wall is but an extreme exaggeration of its possible congenital dystopia, the organ taking the anterior instead of the normal posterior ascent. If, in its forced excursion upward violating gravity, visceral influences, growth, and arterial traction one stem refuses to give up its nutritive right the kidney is tethered and with development and embryological growth the artery thickens and becomes permanent, fascial increase is noted and the kidney is anchored in moorings which nature has not intended.

Pathology That anomalous kidneys, the fused, *nieren kuchen* sigmoid, or horseshoe



Fig 5. Three kidneys and three jules. The lower one on right hand side had numerous tubercle bacilli.

kidney should be invaded by some pathological state and is particularly liable to disease and a morbid reversion, has been well established and appears to be constantly found. The case of Dr J W VanderVeer well illustrates this (Fig 4).

"An anomalous right kidney (no kidney found on the left side) with the right ureter coming from the upper half of the pelvis; the upper pelvis communicating with the lower pelvis and left ureter; a stone present in the pelvis with the upper two thirds of the kidney polycystic and the lower third normal kidney tissue."

In cryptorchismus and hernia of the ovary that these organs tend to malignancy is well known. This malignant predisposition seems to obtain also in the acquired ectopic kidney. An anomalous illustration is that mentioned by Reteke in 1868.

He reports in extensive detail a case of dislocation of both kidneys as the result of a fall from a wagon wheel to the ground.

The patient struck his back upon the hub of the wheel and the wagon tongue and from there he fell to the ground striking firmly on the buttocks. He noted a severe pain in the back at the time and became unconscious for 10 or 15 minutes. Subsequent developments showed traumatic right wandering kidney. The patient declined operative fixation and left the hospital much improved June 30, 1894. In January, 1897 he developed chills and fever, and pain in the abdomen and back similar to the symptoms he showed at the time of dislocation of the right kidney only this time the pain

was on the left side. In the interim the right mobile kidney had also given him trouble. Both kidneys were displaced downward to a considerable extent. The condition of the patient grew worse so rapidly that malignant disease of the left kidney was suspected. Surgical measures were again refused. Death October 29, 1897.

The writer is convinced that malignant disease of the left kidney had developed but autopsy was also refused.

A résumé of the necropsy findings in 18 authentic cases of bilateral ectopy shows the following constant development inhibition:

- 1 Kidney fixed, densely bound down, flattened
- 2 Pelvis usually situated anteriorly.
- 3 Located about sacro-iliac synchondrosis, i.e., below the pelvic brim
- 4 One small single artery, may be as many as six twigs, entering the organ at an abnormal site
- 5 Veins multiple, much enlarged, emerging at an angle
- 6 Adrenal bodies in their normal sub-diaphragmatic locations
- 7 Lobulation of the kidney
- 8 Hypoplasia of calyces
- 9 Ureters are standard but shorter

Associated with ectopic kidney, any genital anomaly may be observed as epispadias, and hypospadias, extrophy, bicornate uterus, cryptorchismus, atresia of the anus, absence of vagina, absence of one ureteral meatus, etc.

The writer has reported the case of three ureters and three pelvis, two on the right side, the lower one of which had developed a tubercular invasion with hamaturia and urinary distress (Fig 5).

Most cases of renal dystopia, however, are recognized on the table in the course of an abdominal operation, the condition having been unsuspected.

We are limiting our discussion to and considering only the congenital dystopic kidney and not the wandering kidney regardless of its degree of movability for the mere fact that it moves differentiates the two for the congenital ectopic kidney whether in the pelvis or abdominal cavity, is bound down by fascial bands and enjoys no excursion.

Differential diagnosis. Strube states that the literature contains quite a number of

cases of double dystopia where the kidneys are fused, and gives 28 bibliographic references. In this condition, the hypertrophied meatus, the excessive peristalsis, capacious, confluent pelves on pyelography and mesial location, should differentiate the horseshoe ectopy from bilateral dystopia — which is relatively much rarer.

The condition seems to be equally divided between the sexes, and it is at the average age of 30 that surgical comfort has been sought.

Subjective symptoms are famously unsatisfactory. Rovsing, however, calls particular attention to pain in the abdomen, lumbar region, and beneath the epigastrium. This pain radiates downward and is relieved by prolonged rest in bed. There is also throbbing and a sense of pressure which is aggravated by leaning backward.

Neufville reports a case in which there was compression of the abdominal vessels and thrombosis of the iliac and femoral veins causing edema of the legs and ascites.

Green and Brooks refer to a case in which a woman gave birth, both of her kidneys being in the pelvis, at a later day with twin pregnancy, the greatly enlarged uterus causing compression strangulation of the kidneys and gangrene. The condition was recognized at autopsy.

A routine abdominal examination is particularly indicated when renal dystopia is suspected on account of genital anomalies.

The possibility of ectopic kidney, unilateral or bilateral, should be borne in mind in all tumors about the brim of the pelvis and particularly in those instances when the kidney cannot be felt in its normal bed.

Rectal examination should be thoroughly carried out.

The phenolsulphonphthalein test is not of peculiar diagnostic value, X ray shadows

of soft tissues in the abdominal cavity are notoriously misleading.

Urinalysis is not significant and conclusive, for urinary findings and cellular elements may obtain in any renal state.

Morbid states of the ectopic kidney and stone inclusion confound rather than simplify the diagnosis. The embarrassment to neighboring organs is as well misinterpreted.

Cystoscopy may reveal the meati normal or in an abnormal location, hypertrophied and showing excessive peristaltic waves, the catheter being arrested at the location of the tumor. In cases of cystitis and contracted bladder, indigocarmine may be used to locate the *ureteral ora*.

It is by ureteral catheterization, injection of colloid silver, and X ray that a constant and reliable means for positive diagnosis can be brought out, for pyelography decides not only the location and capacity of the pelvis, but anatomically differentiates the tumor from a hydronephrotic sac, a revelation which the metal stilette could not accomplish.

Treatment Treatment is that of the arising surgical indication. If observed in the course of a laparotomy performed for some other separate pathological state, nothing should be done. It is with the state of pregnancy and pressure constriction that radical surgical intervention must be adopted, the unoffending kidney balanced, and if not found wanting, the aberrant organ removed. It would appear that this congenital anomaly borne for many years must undergo a distinct pathological reversion to bring out a train of symptoms which would be referable only to the urogenital system. On these occasions routine examination will determine for the surgeon the indications, method and character of operation.

CORRECTION OF DEPRESSED FRACTURES OF THE NOSE BY
TRANSPLANT OF CARTILAGE¹

F. H. BICKMAN, M.D., F.A.C.S., ROCHESTER, MINNESOTA

From the Mayo Clinic

A LARGE number of nasal deformities resulting from injury are of a depressed type, that is, the injury has crushed the nasal bones so that the bridge of the nose is flattened. The nasal bones are either forced backward upon themselves or separated and pushed out laterally in such a manner that the bridge of the nose is broadened as well as depressed. Many of these, if treated immediately, can be replaced and held with splints. The intranasal splint made of hard rubber and the external splint composed of sheet lead are at times both exceedingly valuable. If such a fracture has been allowed to heal without the bones being replaced a marked deformity often exists. A very slight deformity of the bone may produce marked disfigurement of the entire face.

Various methods of correcting these deformities have been tried. One of the commonest has been the transplantation of a portion of bone from the anterior portion of the tibia. A great deal has been written within the past few years in regard to the trans-plantation of bone, fascia and fat

Scarcely any mention has been made in the literature in regard to the trans-plantation of cartilage. Adult cartilage can be transplanted from one portion of the body to another under the same conditions that bone is transplanted, with uniformly good results.

Transplantation of cartilage differs from the trans-plantation of bone, because it is not necessary for the viability of the transplant that the cartilage should be in contact with other cartilage or bone. We have also found that it is not at all necessary to preserve the perichondrium in order to secure a good result. Experimental work by Maccewen in the trans-plantation of embryonic cartilage shows that young cartilage when transplanted into the subcutaneous tissues continues to grow, and in this way a great many cartilaginous tumors have been produced in animals. Davis' work shows that when adult cartilage is transplanted it lives with no apparent growth or change in its composition, up to three months.

We have several cases in which adult cartilage has been transplanted from the rib into



Fig. 1, a Before operation



Fig. 1, b Before operation



Fig 2, a After operation



Fig 2, b After operation

the nose for the purpose of replacing a defect in the tissues there. Some of these cases have gone two and one half years with no apparent change in the size of the transplant. The tissue accepts the transplant very kindly and even in one case of marked infection the cartilage finally healed in firmly. It is not necessary to transplant cartilage immediately. In one instance a portion of cartilage had been removed from the sternal end of the rib for the purpose of transplanting into the nose, but on account of the congested condition of the patient from the anæsthetic, pneumonia being feared, the cartilage was placed in salt solution and confined in a refrigerator for five days. At this time the patient was again anæsthetized, the cartilage removed from the salt solution, and transplanted into the nose. Primary union occurred just as if fresh cartilage had been used.

TECHNIQUE OF OPERATION

If the nasal bones are widely separated it is best to refracture them and place a lateral splint upon each side of the nose, letting the splint remain for five or six days in order to procure a suitable narrowing of the bridge of the nose. As soon as it is certain that there are no breaks in the nasal mucous membrane and that the circulation about the nose is again perfect, the transplant can be made. I have followed the custom of taking a por-

tion of the costal cartilage from the seventh rib since the cartilage is much broader at this point and a good sized portion can be obtained, still leaving costal attachment between the ribs and sternum. One is often surprised to find that a large portion of cartilage is necessary to remedy an apparently small defect. A wax model of the nasal defect is valuable as a guide in shaping the cartilage which may be easily whittled with a scalpel to any desired size or shape. No attention need be paid to the perichondrium.

An incision a quarter of an inch in length is made transversely through the skin over the nose and just between the two inner canthi at a point where the bridge of the ordinary spectacles rest. There is usually a slight wrinkle in the skin at this point so the scar is not visible. With a periosteal elevator the skin and subcutaneous tissues are elevated from the bone and cartilage straight down the bridge of the nose nearly to the tip. The separation should not be carried laterally on either side farther than necessary to secure room to transplant the cartilage. The transplant is then slipped into place, and, as the tissues have been separated only in the midline, the transplant is held in place and is not dislodged to either side. It may be necessary, however to place a stitch at the upper portion of the trans-plant to keep it from slipping upward. The small incision



Fig 3 Before operation



Fig 4 After operation

is closed with two or three interrupted stitches of horsehair, the wound sealed with cotton and compound tincture of benzoin.

In my first attempt to transplant cartilage into the nose an incision at the rim of the nostril was made, the cartilage inserted at this point. This method has also been recommended by Babcock. It is not so satisfactory as the method herein described be-

cause the dissection cannot be kept exactly in the midline and consequently the transplanted cartilage is apt to slip sideways. The risk of infection is also much greater in the former method. The only infection in our cases was the one in which a transplant was placed in through the nostril. The accompanying photographs illustrate the points in the technique and the results obtained.

SOME INTERESTING EXPERIENCES IN THYROID SURGERY¹

By ALEXIUS McGLANNAN, M.D., BALTIMORE

THE INFLUENCE OF CHRONIC TONSILLITIS ON EXOPHTHALMIC GOITER

INCREASED activity of the thyroid gland is one of the many factors involved in our resistance to infection. Enlargement of the gland is so constantly associated with the course of an acute infection that it seems a normal function. The intensification of the symptoms of hyperthy-

roidism whenever an infection is engrafted on a previously existing exophthalmic goiter points out the close relation existing between the thyroid gland and the reaction of the organism to injury.

This relationship seems particularly marked when the infection exists in the throat or the accessory sinuses of the nose. For some time we have had our thyroid patients studied

¹Read at the Annual Meeting of the Medical and Surgical Faculty of Maryland.



Fig 1 Photograph¹ of the patient in Case 1 (Sur 5 105, St Agnes' Hospital) before operation

by the rhinologist and any lesion of the nose or throat treated before making the direct attack on the thyroid

The following case illustrates the value of this proceeding

CASE 1 Surgical No 5 105, St Agnes' Hospital White male age 23, occupation farmer The onset occurred five months before admission The initial symptoms were nervousness with tremor of the hands sleeplessness, and some bulging of the eyes Later he noticed enlargement of the neck, intermittent attacks of diarrhoea and progressive loss of weight—twenty pounds in four months The patient gave a history of nasal catarrh lasting 13 years, an acute suppuration of the ear occurring 4 years ago, and an attack of quinsy 14 months before admission

On admission he presented the typical picture of exophthalmic goiter (Fig 1 showing appearance of patient in Case 1) large goiter with distended veins and purring thrill tachycardia with en-



Fig 2 Photomicrograph of section of thyroid from Case 1 (Path 16 455, exophthalmic goiter)

larged area of cardiac dullness, marked exophthalmos with practically all the special eye signs, profuse sweating, gastric hyperacidity, leucocytes, 6 680, small mononuclears, 26.8 per cent, total lymphocytes, 36.8 per cent, urine negative X ray examination did not show an enlarged thymus Examination of the throat revealed large infected tonsils, the crypts of which contained cheesy exudate

After rest in bed for 12 days, the pulse rate had fallen from 140 to 100 On this date Dr Pound removed the left tonsil under novocaine anaesthesia The immediate reaction was quite severe as is shown by the anaesthesia slip record After the operation the pulse rate rapidly fell and at the end of 24 hours it was 110, and after 48 hours 100

Two weeks later the second tonsil was removed The operation was performed with considerably less disturbance, the pulse and blood pressure gradually falling after the initial excitement had subsided The post operative tachycardia was rather persistent, the pulse rate averaging about 120 for ten days After this time the rate was usually from 100 to 120, averaging 112

Two weeks after this tonsil was removed, that is, 30 days after admission and 27 days after the first tonsillectomy, I removed the right lobe of the thyroid under novocaine and drop ether anaesthesia During the operation the pulse rate averaged 130 and the blood pressure 160 The anaesthesia slip shows how slightly the patient was disturbed by the operative manipulations During the first 24 hours after operation the pulse rate varied between 130 and 150 and during the next 24 hours came down step by step to 110, reaching a range between 80 and 100 on the fourth day after operation

¹Photographs for Figs 1, 2, 3, 4, 5 and 6 by Mr H Schapiro Pathological specimens from the Surgical Pathological Laboratories of the Johns Hopkins Medical School and the College of Physicians and Surgeons Baltimore



Fig 3 Photograph of the patient in Case 2 (S 2,849, Mercy Hospital)

Pathological examination of removed thyroid shows advanced exophthalmic hypertrophy (Fig 2). The cut surface has the appearance of muscle with some areas of colloid remaining in the gland.

The beneficial effects of the tonsillectomy in this patient are, first, the diminution in the intensity of the hyperthyroidism after the removal of the tonsils which permitted the very satisfactory and safe removal of the thyroid lobe, second the absence of severe reaction after the lobectomy which was no doubt due to the preliminary unburdening of the system by means of the tonsillectomies. It

is most unusual to have so prompt a recovery with so little intoxication following operation for so well marked an exophthalmic goiter.

LARGE SIMPLE GOITER WITH HYPOTHYROIDISM

CASE 2 Surgical No 2,849 Mercy Hospital
White female, age 37, the mother of six children,

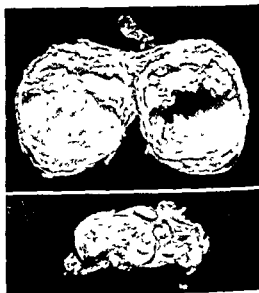


Fig 5 (above) Photograph of cyst with ossification of the walls, removed from patient in Case 3 (S 1,363, Mercy Hospital)

Fig 6 Photograph of the mass removed from patient in Case 4 (Path 904, aberrant thyroid)

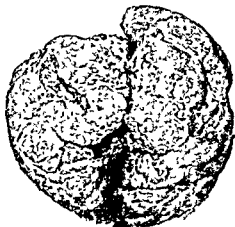


Fig 4 Photograph of lobe removed from patient in Case 2 (Path 1,746 simple goiter)

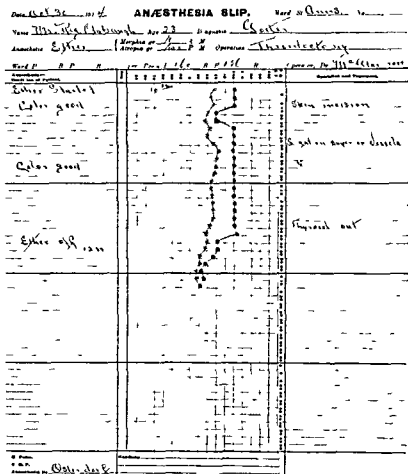


Fig 9

have had areas of calcification and of bone in simple goiters and thyroid adenomas, but this is the largest calcified mass in our collection (Fig 5)

After the operation the patient recovered without any complications, and although no more thyroid extract was administered his skin remained healthy. We hope that the improved circulation in the left lobe that must follow the relief of pressure brought about by removal of this mass will so add to its function as to meet the demands of his body

ADENOMA OF LATRAL ABERRANT THYROID

CASE 4 Surgical No 228 Mercy Hospital White male, age 27 Patient has had a lump in the posterior triangle of the left side of his neck for three years This has gradually become larger

and lately has become tender On examination a number of enlarged glands were found on both sides of the neck, both anteriorly and posteriorly The glands of the groin also were found enlarged The mass noticed by the patient was larger than any of the swollen glands and was the only tender one There was no fever, leucocytes, 5,400, small mononuclears 20 per cent, total lymphocytes, 26 per cent The patient did not react to a tuberculin injection

The pre operative diagnosis was glandular enlargement due to lucas or to Hodgkin's disease When the mass was exposed in the wound and the characteristic greenish red vascular capsule came into view, the thyroid tumor was recognized and removed

Pathological examination of the tumor showed the usual picture of colloid adenoma of the thyroid with some thyroiditis

THE RÔLE OF OXYURIS VERMICULARIS IN THE ETIOLOGY OF APPENDICITIS AND ALLIED PATHOLOGICAL CONDITIONS¹

By KWANOSUKI SUZUKI, M.D.

First Surgeon, 4th Imperial Japanese Navy

ALTHOUGH the above subject has long occupied the attention of numerous writers, this problem has not yet received its solution. The opinions touching it are very varied, some workers considering the presence of the oxyuris in appendicitis to be purely accidental, while others attribute great pathological significance to the presence of but one such organism. Nothing would be gained by reviewing the existing literature on this subject. I will therefore confine myself to a few brief comments on one or two important contributions to this subject, and then pass on to an exposition of my own findings.

The point of first importance is that which during the past few years has served as the basis of the controversy existing between Rhinendorf and Aschoff, and which has not yet reached its solution. As is known, Aschoff² formerly maintained that the parasites were unable to play an important etiologic rôle in appendicitis. At that time out of a thousand appendices examined by him, of which the greater number were pathologically affected, only two cases were found by him to exhibit the presence of oxyuris. On the other hand, Rhinendorf³ has since 1912 published several papers on the subject of the oxyuris as a factor in appendicitis, in which he declares that this parasite plays an important rôle in the etiology of the disease, especially in the case of children, and that it is far from being the harmless parasite it was formerly held to be. In his first work, Rhinendorf published the result of the examination of thirteen appendices, all derived from children from three to twelve years old, who had appendicitis. Six of these cases showed the oxyuris in the appendix (47.6 per cent). His microscopic illustrations show the pres-

ence of a deeply fissured ulceration at the site where the organisms were found in the mucous membrane. The bed of the ulcer, together with various ramifications of the same, extends practically to the musculature. At the edges of the same a moderate leukocytic infiltration is visible.

Aschoff⁴ later on changed his opinion with respect to the matter, and in part confirmed the statement of Rhinendorf by declaring that the pathologic condition provoked was not true appendicitis but a diseased condition similar to the latter, caused by the oxyuris, which condition he termed "appendico pathia oxyurica". The point most hotly contested by these two authors is whether the oxyuris can provoke a fissured and canalicular formation in the mucous membrane. Rhinendorf affirms that this is the case, while Aschoff most persistently denies its possibility, and even insists that this formation is merely an artefact.

In 1913 Rhinendorf⁵ published a fresh contribution to the subject, entering exhaustively into a description of the pathologico-anatomical changes brought about in the wall of the appendix by the parasite. At the same time he declared most emphatically that the cleft in the mucous membrane could undoubtedly be produced by the oxyuris, and was by no means an artefact.

Recently Rhinendorf⁶ has issued an additional contribution reaffirming his last statements, in which he further explains that the cleft formed by the oxyuris is to be differentiated from another due to an artefact. But Aschoff⁷ replied to this by de-

¹ Aschoff: *Appendico pathia oxyurica*. *Med. Klin.* 1912, 18, No. 17.

² Rhinendorf: *Über die durch die Oxyuris vermicularis hervorgerufenen pathologisch-anatomischen Veränderungen in der Wand des Wurmfortsatzes*. *Frankfurter Zeitschr. f. Path.* 1913, 3, No. 2, 111.

³ *Oxyuris vermicularis* ist unter der mikroskopischen Zuflächung die Ursache zur Appendicitis, Frage und deren Beantwortung zur Oxyuris. *Lehrb. klin. Medizins* 1913, No. 2, and 28, 1211, 1212.

⁴ Aschoff: Sind die Wurmfortsätze der Oxyuris direkt oder indirekt schuldig an der Appendicitis? *Beitr. klin. Medizins*, 1914, No. 32, 3304.

Aschoff: *Die Wurmfortsatzentzündung*, 1908, Jena.

Rhinendorf: *Die Frage zur Frage der Bedeutung der Oxyuris bei der Wurmfortsatzentzündung bei Kindern*. *Beitr. klin. Medizins*, 1913, No. 10 und 11, 131, 135.

⁷ A work was made in the First Intern. Cong. 1913, until August, 1914, in the Path. Inst. of the 3rd St. Krankenh. (Urban, Berl.) under the direction of Dr. Max Kist. Director of the Institute. There wish to express my sincere thanks to Dr. Kist for his friendly assistance in the work.

claring that the oxyuris clefts of Rheindorf were purely artificial in origin. Nevertheless, he confirmed some of the other statements of Rheindorf. Among other remarks we find the following: "(2) The description made by me several years ago of the pathologic picture of pseudo appendicitis, due to the presence of oxyuris, has been acknowledged by Rheindorf and confirmed in its essential points. (3) The fissure formations in the mucous membrane of the appendix described by Rheindorf and attributed by him to the entrance of the oxyures, are for the most part artificially produced. (4) So long as we have no proof that the oxyures are able to provoke coarse epithelial defects or tissue destruction we are similarly unable to accept Rheindorf's statement that the oxyures are indirectly connected with acute appendicitis."

In addition to the two authors quoted above, various other investigators have offered contributions to the solution of the problem. Hippus and Lewinson¹ in their earlier writings have also expressed the opinion that traumatic lesions of the wall of the appendix are caused by the oxyures and that infectious agents are thus able to penetrate into the tissue of the appendix. This opinion is theoretically quite correct although inflammation is not always caused by the presence of the oxyures in the appendix, even in cases where the organisms penetrate deep into the mucosa, and sometimes also into the lymph nodules as far as the proximity of the submucosa or the musculature where they cause traumatic injury to the wall of the appendix.

Latterly N. Sagredo has examined 100 appendices which were extirpated in connection with appendicitis among which he found 41 cases showing the parasites or their eggs. These 41 appendices with the exception of 6 cases showed no important pathological changes. On the other hand appendices exhibiting intense inflammation very rarely show the presence of the parasite. The 35 cases, therefore, which were operated upon for appendicitis like symptoms must through the agency of the oxyures have pro-

voked a clinical picture identical, not with that of appendicitis, but, to use Aschoff's designation, with that of "appendicopathia."

It appears to us erroneous to attempt to explain this question merely from a consideration of the statistical data, without undergoing a thorough investigation of the pathologico-anatomical changes in the appendix wall, for, on the one hand, the appendix can harbor the oxyures without any accompanying abnormal clinical symptoms and, secondly the patient may be suffering from acute pain in the region of the caecum even in the total absence of the parasite. From Sagredo's article we are left uninformed as to the whereabouts of the oxyures in the appendix, and furthermore what is the nature of the anatomic changes (other than the inflammatory process) brought about by the nematode, and what is their connection with the clinical symptoms? According to our own investigations the anatomical changes of the appendix accompanying the presence of the oxyures are not only inflammatory, but traumatic disturbances, localized necrosis, and intense hyperplasia of the lymphatic tissue, etc.

Hueck² examined 78 resected appendices, amongst which he found 14 cases of oxyuris in the lumen of the appendix and one case of the organism in the submucosa. He made microscopical examinations of cross-sections from at least three different places in each of the appendices (usually proximal, medial, and distal), and summed up his investigations in the following words: "This points to the fact that in many cases often designated as appendicitis the agent responsible for the infection is the nematode. According to my own experience the oxyures alone are to be held responsible for the specific complications of the appendix. Thus we are concerned not with appendicitis, viz. an inflammatory reaction, but with a diseased pain producing condition of the appendix, which may be termed "appendicopathia oxyurica."

The same author found no cases in which true inflammation was caused by the oxyures or in which the wall of the appendix had been

¹Hippus and Lewinson: Oxyuris et Appendix. Deutscher Med. Wochenschr. 1907 XXXIII, No. 11, p. 50.

²Hueck: Über die pathologische Bedeutung von Helminthiasen in der Appendix. Frankfurter Zeitschr. f. Path. 1915, 21, No. 3, 434.

traumatically injured. He confined his observations to resected appendices, and, unlike Sagredo, studied no normal cases.

Matsuoka¹ recently examined 103 appendices, and a part of his findings have already been communicated by Aschoff. Matsuoka found 33 cases of recent (histologically confirmed) appendicitis (9 per cent) and 26 cases showing the oxyuris from among 70 cases without any recent inflammation (37 per cent). For a detailed account of his findings we must await the publication of his entire work.

I should here like to emphasize the importance, in the study of oxyuris appendicitis, of examining not only resected appendixes but also normal appendices derived from post-mortem material. In my own study of post-mortem cases I found several cases of localized oxyures, unaccompanied by any apparent anatomic changes or other symptoms.

At the instigation of Dr. Max Koch I endeavored to cast some light on this problem. The main points which have attracted attention are the following:

1. What are the pathologic anatomic changes produced in the appendix by the agency of the oxyures and of anatomical changes to be regarded as artefacts?

2. Can the inflammation, whether acute or chronic, be caused by the oxyures?

3. Can a disease of the appendix, similar to appendicitis, be provoked by oxyures without any accompanying inflammation?

4. Can the last named disease of the appendix arise in the wall of the process without any apparent anatomic changes?

5. What is the percentage of the cases of inflammatory or other pathologic conditions in connection with the oxyures?

For the purpose of solving the above questions I examined 500 post-mortem cases, among which were 44 oxyuris cases. The appendices of these 44 cases were cut into serial sections and subjected to careful microscopic examination. In addition to this post-

mortem material examinations were made of 103 appendices which had been extirpated from patients suffering from appendicitis. Serial sections were made from the material taken from children under 17 years of age, and sections of the appendices obtained from the patients above the age of 18 were cut in serial sections, and subjected to careful microscopic examination at intervals of from five to ten sections.

PREPARATORY STUDIES

As a preparation for my investigations I made a histologic comparison of the species oxyuris and trichocephalus. These two nematodes are somewhat similar in aspect when examined microscopically, especially when seen in a cross section of their anterior end, although microscopically they are very unlike and can be distinguished at a glance. Specimens of these nematodes taken from post-mortem cases were fixed in alcohol (bismite (1:4), embedded in paraffin in the usual manner, cut 5 microns thick in various directions, stained with hemalum eosin, and examined microscopically (Figs. 1 and 2). I wish to say that the use of the hemalum stain is very much to be recommended in the examination of these parasites, for the cuticle, consisting of a chitinous substance stained intensely with eosin and acquires a clear shining aspect, whereas the viscera for part, as well as the yolk in the egg, take up the hemalum stain. The egg shell in both species remains unstained sharply outlined, reflecting the light in various other attempts at staining, but to obtain equally satisfactory results.

It is to be noted that the cuticula takes on the eosin so intensely greatly facilitates the recognition of the oxyures, and thanks to this we are easily able to detect the parasites in the tissue of the most minute portions of a worm. In cross sections of the posterior end, the two organisms can be easily distinguished by the difference in the anatomical position of the viscera; also the mas-

¹ Aschoff, Sanido-Warner, Lewin, *Die Oxyuren, direkt ektopisch direkt ektopisch* (Schuld an der Appendicitis?) *Beit. Klin. Wochenschr.* 1914, No. 51, 1574.

² This material was obtained from the Director of the U. S. Army, and the use of it is a privilege of the U. S. Army. I have wish to express to the U. S. Army my sincere appreciation of its generous aid.

sive cuticula in the neighborhood of the organs possessed by the trichocephalus, as well as by the form of the eggs. But in a cross section of the anterior end of the body the two species are often seen to bear close resemblance to one another. It is especially difficult to determine the species when in a section of the anterior end a fragment of the cuticula and of the pharynx or œsophagus is seen. I have, however, discovered a satisfactory means of differentiating the two types, for under a strong magnification the cuticula of the trichocephalus is seen to consist of two layers, an outer colorless layer and an inner layer stained with eosin, whereas in the oxyuris the cuticula consists of but one layer, sharply stained with eosin (Figs. 3 and 4). In transverse sections of the anterior part of the body, I have found yet another important point of differentiation. This consists in the fact that whereas in trichocephalus the musculature of the pharynx and œsophagus consists of a dotted side by side disposition of the small bundles of muscles, in oxyuris on the other hand it is seen as a long, uniform, and uninterrupted band of muscle.

As has been remarked, the eggs of these two nematodes, when seen in their entirety, vary greatly in respect to their general shape and can be differentiated at a glance. But in my investigations I was not able always to easily recognize an isolated egg which happened to be situated in the lumen or in the tissue, and thus was especially the case where the sections of the eggs of the trichocephalus were neither directly transverse nor vertical, and where, as a consequence, the characteristic covering at the two poles was not present. In such cases there remains but one manner of differentiation, and that is the fact that in the oxyuris the yolk takes the hemalum stain fairly intensely, whereas the trichocephalus almost entirely fails to do so, moreover that in oxyuris a broad intervening space is present between the egg shell and the yolk, whereas in trichocephalus no such space is seen (Figs. 5 and 6). It is sometimes very important to discover the isolated unattached eggs which may be situated in the lumen or tissue, for one is thereby enabled to assume that the appendix is infected with the nem-

atodes. In the tissue we sometimes find an empty egg shell, but even then the two species can be distinguished by the fact that the egg-shell of oxyuris reflects light more sharply and that its contour is more distinctly outlined.

A transverse examination of the appendix is to be recommended in the majority of cases, as such a procedure best demonstrates the various relations which may exist between the processus and the nematodes. It is generally known to be exceedingly hard to point out the exact situations of the worm in relation to the appendix-wall when the organism is situated longitudinally in a fold of the mucosa, and examined in a longitudinal section, because the portion of the parasite which appears in such a section does not indicate whether it is actually lying within the fold or outside of the same. Longitudinal sections were prepared only occasionally, when necessary.

The histologic differentiation between male and female specimens of the oxyuris can only be made in longitudinal sections or in transverse sections through the part of the body containing the genital organs. In the female the genital tract is usually completely filled up with eggs (Figs. 7 and 8). Apart from this point, the sex of the nematodes cannot be made out histologically.

If we wish to institute a detailed investigation of the connection of the oxyuris in appendicitis, we must examine the whole appendix by means of continuous serial sections, or at least one out of every 5 or 10 sections throughout the entire processus, although this involves a great amount of labor. Hueck made microscopical examinations of only three transverse sections taken from different sites (usually proximal, medial, and distal), but I hold this procedure to be entirely too crude.

EXAMINATION OF POST-MORTEM MATERIAL

I examined 500 cadavers, finding the oxyures in 44 cases, as follows: 29 times (66 per cent) in the cæcum and appendix, 6 times (14 per cent) in the cæcum alone, and 9 times (20 per cent) in the appendix alone.

The following table shows the results with respect to oxyuris of the examination of the 500 post-mortem cases.

Age in Years	Number of Cadavers Examined			Total Number of Oxyures Found			Number of Trichophalus Found	Proglot des Ta (worm)
	Male	Female	Total	Male	Female	Total		
1	13	8	21	0	0	0	1	
2 to 10	14	8	22	10	3	13	2	
				71 per cent	38 per cent	50 per cent		
11 to 20	17	11	28	4	1	5	2	1
				9 per cent	9 per cent	18 per cent		
21 to 30	25	16	41	2	0	2	3	
				8 per cent		5 per cent		
31 to 40	48	18	66	5	1	6		2
				11 per cent	6 per cent	9 per cent		
41 to 50	47	18	65	3	0	3	1	
				6 per cent		5 per cent		
51 to 60	60	22	82	6	1	7	1	1
				10 per cent	5 per cent	9 per cent		
61 to 70	67	21	100	1	1	2		
				4 per cent	5 per cent	4 per cent		
71 to 80	31	29	60	4	0	4		
				12 per cent		7 per cent		
81 to 90	6	5	11	0	0	0		1
	110	170	300	33	11	44	10 (2 per cent)	5 (1 per cent)
				10 per cent	6.5 per cent	8.8 per cent		

* Only in the appendix

The various authors are unanimous in affirming that the percentage of cases in which the oxyuris is found is much greater in children than in adults. Out of 11 cases of children who failed to harbor the organism in the cæcum when examined by means of selective serial sections 6 showed its presence in the appendix.

Age in years	Number of appendices examined	Number of cases showing oxyures
3	6	1
2	1	1
6	1	1
7	1	1
9	1	1
14	1	0
	11	6 (55 per cent)

The examinations showed that when the consistency of the faeces in the cæcum was hard, it contained more oxyures than when the faeces was liquid. In the latter cases the parasites were usually found in the lower part of the colon.

I examined all the appendices showing oxyures in the cæcum (in serial sections) under the microscope fixed with formalin *in toto* without opening embedded in paraffin, then stained with alum hæmatin eosin. The result of my examination is as follows:

Specimens of oxyuris found only in the lumen	29
Specimens of oxyuris found in lumen and in	
gland tube	3
deep gland tubules	2
mucosa	3
lymph nodes	1
No specimens of oxyuris in appendix	6
Specimens of trichophalus found in lumen	6
Five worm proglottides found in lumen	5*
Altogether found macroscopically	

1. *Oxyures found in the lumen.* Sometimes the oxyures are found in the lumen of the appendix (the mass of faeces being of varying consistency), situated in part between the faeces and the wall of the processus, at other times they are found in the lumen alone, some times surrounded with mucus. Occasionally only a few eggs, either isolated or in groups, are seen in the lumen distributed among the faeces without any parts of the parasites themselves being present (Fig. 9). The origin of these eggs may be accounted for in two ways. First they may have entered the lumen of the appendix either through traumatic bursting of the fenile or through its deformation brought about by any other means. Second, they may have emerged from the body of the female when the latter was in the cæcum and thence have proceeded to enter the lumen of the processus, together with the faeces. Nevertheless, I am inclined to the opinion that when an egg is found in a

group it will have left the body of the mother while the latter was in the lumen of the appendix. Occasionally a free, isolated egg is found in the tissue (Fig 10). Rheindorf holds that the fertilized oxyuris eggs are deposited in the lumen of the appendix, and that they there develop into the embryonic organism and finally into the adult. Some years ago Kuchenmeister represented the view that the oxyures were able to develop in the cæcum and appendix beside the adults, without the necessity of their previously passing through the mouth and stomach of the host. Heller and others believe this opinion to be erroneous. Hueck stated that it was hard to say with certainty that they had been liberated through the deformation of the female. Michelson¹ and Vignolo Lutati² had earlier proved that the eggs can continue to develop on the skin.

In order to elucidate this point I instituted a number of experiments. Two dogs were fed by mouth with a number of oxyures bearing fertilized eggs and in two other dogs the impregnated females were introduced directly into the cæcum. My object was to ascertain whether or not the oxyuris could develop in the intestine to the adult stage without undergoing a passage through the outer world. But contrary to expectation the oxyures failed to develop in all four experiments. Of course this experiment must be pursued still further in order to decide the question, but so long as we have no proof that the oxyuris eggs are deposited in the intestine and there develop into the adult form I am inclined to think that Rheindorf's theory is erroneous. At all events I myself have never seen in the appendix cases of embryonic organisms which had recently left the egg. The above stated findings, on the contrary, incline me to the belief that eggs found in a large group, whether in the appendix, the lumen or the tissue, must have been forced out of the body of the mother through some special cause but that only eggs found free and isolated can be taken as having been deposited naturally.

The formation of depressions in the mucous membrane, corresponding to the position of

the oxyures is, according to my mind, merely mechanical in origin, and is produced by the pressure of the worms on the mucosa. These depressions, moreover, are most pronounced when the oxyures are situated between the hard fecal mass and the mucosa (Fig 11). On the other hand, when they remain quite loosely in the lumen, where there is no fecal matter, no depression whatever is noted (Fig 12). This depression is sometimes seen to be deeply indented, in which case the oxyuris will penetrate the same, and it will appear at a glance as if the worm had bored through the mucosa (Fig 13). Examination with a high-power microscope, however, shows that no traumatic disturbance of the tissue is involved, that the edge of the adjoining mucous membrane is uniformly smooth, and that the cells at this place are sometimes greatly compressed. The epithelium, however, is often entirely absent at this place or very much injured, and at times extensive maceration of the epithelium is to be noted.

Rheindorf thought that the destruction caused to the epithelium by the oxyures was not to be attributed solely to the purely mechanical effect of the movements of the anterior and posterior ends of the body, but that a contributory factor might be a certain chemical noxa given off by the parasite, resulting in the destruction of the epithelium. My own observations, however, do not lead me to support this theory of Rheindorf, as neither defects nor maceration of the epithelium were to be seen in cases where the oxyures failed to exercise pressure on the mucosa, or, in other words, where no mechanical effect was produced by the action of the worm on the mucosa. In cases where the oxyures in the lumen are not in such close contact with the mucosa the epithelium invariably remains intact. If it were really destroyed by some chemical action, the epithelium in the neighborhood of the oxyuris would always have to be injured even though no mechanical action had here taken place. I had no difficulty in explaining these conditions. Figure 14 shows some sections of oxyures in the lumen together with some mucosa, and one specimen of the organism is even seen to be quite close to the mucosa. But the epithelium in its

¹ Berl klin Wchnschr 1877 No 33

² Arch f Dermat 1888 vi

entire circumference is well preserved. In another figure we have a transverse section of two oxyures in the lumen, surrounded by liquid faces, here, however, we see neither destruction nor maceration of the epithelium (fig. 15). In another case the greater part of the epithelium is absent at the site of the location of the oxyures, the edge of the mucosa, nevertheless, is perfectly smooth and no tissue destruction has taken place.

Rheindorf has further stated that between the ulcerated mucous membrane and the oxyures could be seen an agglomeration of leucocytes, lymphocytes and detritus with a possible admixture of the faces of the parasite. This statement is correct for we do see such a mass of detritus in the lumen of the appendix. But it is conceivable that this mass of detritus is on the one hand a physiological result of the metabolism of the host and secondly a result of the long continued mechanical irritation produced by the worms or by the hard fecal matter. My own preparations often failed to show any such formation of detritus, but merely a certain amount of mucus, although the oxyures were in contact with the mucosa.

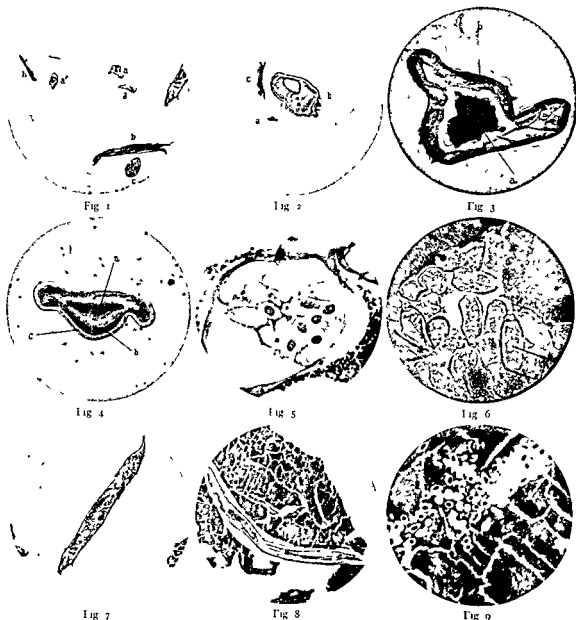
My own observations therefore induce me to state that the destructive effect of the oxyures on the epithelium is only to be attributed to a mechanical cause and that we can hardly entertain the theory of the liberation by the parasite of a chemical noxa. Rheindorf even holds that a chemical noxa capable of causing epithelial destruction is given off by the isolated egg, but even this hypothesis is unacceptable as the existence of the isolated eggs is not always associated with tissue decomposition.

Rheindorf attributes great pathological importance to the destruction of the epithelium of the mucosa. My own investigations have shown that the epithelium in post-mortem cases is indeed greatly disturbed even when no oxyures are found in the appendix or any other pathological changes are seen to occur. The material extirpated from the appendicitis patients, on the other hand, usually shows a well preserved epithelium, even when oxyures are seen to be present and even when severe histological lesions are

found. These findings incline one to the belief that part of the epithelial destruction found in the post-mortem material is to be considered as due to post-mortem decomposition. The material obtained from operated cases was fixed immediately after extirpation, while yet warm, but post-mortem material was fixed later, after death. In children's cadavers 10 per cent formalin solution was sometimes injected into the abdominal cavity as soon after death as possible, in order to prevent post-mortem decomposition. It should be emphasized that all epithelial destruction found in post-mortem cases must be examined with the utmost care and should be carefully distinguished from post-mortem changes.

2. *Oxyures in the gland tube.* Two specimens of oxyuris were found in which the head had penetrated the gland tube, while the body had for the most part remained in the lumen. One of the accompanying illustrations shows an oblong section of the anterior body of the oxyuris which has entered a gland-tube, the epithelium of which has been completely destroyed by the worm where it is in contact with the organism. The wall of the gland tube was quite smooth, and no tissue destruction here took place. In another illustration (figs. 18 and 19) we see that the oxyuris head has half penetrated the gland tube and in the space around the head of the organism a few detached epithelial cells can be seen. Both these cases failed to show either leucocytic infiltration or necrosis of the tissues in the neighborhood of the oxyuris. The rest of the appendix was completely normal.

In one of the sections I found a particle of oxyuris cuticula lying in a deeply-seated gland tube, the epithelium of which had been completely destroyed but the wall of which was as smooth as in the previously quoted cases. This gland tube is situated in the vicinity of the muscularis mucosae. Here likewise there was no leucocytic infiltration nor were there any noteworthy histological changes in the tissue, the entire wall remaining intact (figs. 20 and 21). In another figure (fig. 22) we see a minute scale of oxyuris cuticula lying in the gland tube on the surface of the mucosa, the lumen shows one



Figs 1 to 32 Post mortem material. Fig 1 *a* and *a* Transverse section of the anterior body of *Oxyuris vermicularis*, *b*, longitudinal section of the anterior body, *c* transverse section of the posterior body *d* small fragment of the cuticula of *Oxyuris vermicularis*

Fig 2 *a*, Transverse section of head end of *Trichocephalus dispar*, *b* transverse section of posterior end *c*, longitudinal section of anterior body

Fig 3 Greater magnification of transverse section of head end of Fig 1 *a* *a* Oesophagus *b* cuticula consisting of one single layer intensively stained with eosin

Fig 4 Greater magnification of transverse section of *Trichocephalus*, posterior end, from Fig 2 *a* *a* Oesophagus

b inner layer of the cuticula intensively stained with eosin *c*, outer layer of cuticula, unstained

Fig 5 *Oxyuris* eggs in the uterus, possibly fertilized, coarser yolk intensively stained with alum hematin

Fig 6 *Trichocephalus* eggs in the uterus *a* Plugs at both poles *b* fine yolk, stained with alum hematin *c* eggs at the plug

Fig 7 Longitudinal section through the middle of a female *Oxyuris* filled with eggs

Fig 8 Longitudinal section through middle of male *Oxyuris* at site of digestive tract and seminal canal

Fig 9 Group of free *Oxyuris* eggs, scattered in the hard fecal matter in the lumen of the appendix



Fig 10



Fig 11



Fig 12



Fig 13



Fig 14



Fig 15



Fig 16



Fig 17



Fig 18

Fig 10 An isolated free oxyuris egg in the tissue of the mucosa

Fig 11 Various oxyuris specimens in the lumen of the appendix Arrow shows depression formation

Fig 12 Two specimens of oxyuris in the lumen of the appendix *a* Depression formation *b* enveloped in mucus no depression formation

Fig 13 Various oxyuris specimens in the lumen of the appendix arrow shows mucosa compressed by oxyures

Fig 14 Four transverse sections of oxyuris found in the lumen of the appendix accompanied by some mucus, oxyuris situated quite close to the mucosa Epithelium well preserved

Fig 15 Two specimens of oxyuris situated between the liquid faces and the wall of the appendix Epithelium well preserved

Fig 16 Five specimens of oxyuris in the lumen of the appendix one of which is entering a gland tube (arrow)

Fig 17 Greater magnification of the above preparation *a* Longitudinal section of the anterior body in the gland-tube *b* smooth wall of the gland tube the epithelium is absent at the part adjoining the oxyuris *c* well preserved epithelium at the bed of the gland tube

Fig 18 Three specimens of oxyuris in the lumen one of which is in the act of entering the gland tube with its head



Fig. 19



Fig. 20



Fig. 21



Fig. 22

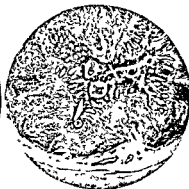


Fig. 23



Fig. 24



Fig. 25



Fig. 26



Fig. 27

Fig. 19 Greater magnification of previous figure. The head end reaches to the middle of the gland tube where several fallen-out epithelial cells are visible.

Fig. 20 A fragment of oxyuris cuticle at the end of a gland tube, several epithelial cells are missing.

Fig. 21 Greater magnification of the preceding figure. Smooth wall of the gland tube (epithelium is entirely absent).

Fig. 22 Two specimens of oxyuris in the lumen between the faeces and the mucosa, one is seen transversely and the other longitudinally; there is likewise a small transverse section in the orifice of the gland tube (see arrow).

Fig. 23 Two specimens of oxyuris in the lumen, a longitudinal section of oxyuris in one gland tube and a transverse section in another.

Fig. 24 Greater magnification of the previous figure (arrow). Several remnants of nuclei of the epithelium of the gland tube sharply outlined. Smooth wall where the epithelium is entirely absent.

Fig. 25 An oxyuris in act of penetrating mucosa.

Figs. 26 to 29 Series showing the condition of the penetration of oxyuris in the mucosa.

Fig. 26 Penetrating mucosa between two gland tubes.

Fig. 27 Further penetration, a gland tube pressed to one side.



Fig. 28



Fig. 29



Fig. 30.



Fig. 31



Fig. 32



Fig. 33



Fig. 34



Fig. 35



Fig. 36

Fig. 28 Penetrating under the epithelium

Fig. 29 Oxyures situated directly under the epithelium the epithelium well preserved

Fig. 30 Two transverse sections of oxyures in the lymph nodules situated quite close to the submucosa

Fig. 31 Oxyuris boring into the mucosa from the lumen the wall of the fissure is quite smooth

Fig. 32 Series following the preceding figure. The oxyuris has bored through the muscularis mucosae and has reached the lymph nodules the wall of the fissure is quite smooth

Fig. 33 Chronic appendicitis lumen filled with hard feces. An oxyuris between the feces and the mucosa

Arrow shows artificially formed cleft, caused by fixation

Fig. 34 Chronic ulcerous appendicitis with extensive destruction of the wall, lumen and defects of the wall which is filled with liquid feces. An oxyuris is seen in the defect as well as some hard fecal matter

Fig. 35 Chronic ulcerated appendicitis. Lumen is filled with hard feces and the wall has been destroyed as far as the muscularis. Three oxyuris specimens are visible in the defective wall

Fig. 36 Acute suppurative appendicitis with perforation. a Perforation b two oxyuris specimens in the suppurated infiltrated lymphatic tissue



Fig. 37



Fig. 38



Fig. 39



Fig. 40



Fig. 41



Fig. 42

Fig. 37 'Appendicitis oxyurica'. This shows a transverse section of the proximal end of a wall. *a* Oxyuris in the lumen, *b*, two oxyuris sections in the mucosa, *c*, scleronecrotic part, *d*, necrosis with hemorrhage.

Fig. 38 Inflamed mucosa and submucosa. Transverse section of the middle part of the wall. Several oxyures in the lumen, embedded in the faeces, several oxyures in the mucosa and submucosa, necrotic destruction of tissue accompanied by hemorrhage in the vicinity of the oxyures. The entire epithelium is destroyed, acute inflamed submucosa (*sb*), circular muscle (*cm*) and long muscles (*lm*).

Fig. 39 Transverse section of distal end of wall. Four specimens of oxyuris in the mucosa, one of which

extends to the submucosa, several slightly necrosed foci with hemorrhage in the inflamed mucosa.

Fig. 40 Transverse section of middle of wall. Torn mucosa, several oxyuris in the lumen, four oxyuris sections in the lymph nodules accompanied by necrosis and hemorrhage.

Fig. 41 Transverse section of the wall at the top of the distal end where the lumen is no more found. One oxyuris in transverse section *a*, necrosis, *b* hemorrhage, *c* acute inflamed lymphatic tissue.

Fig. 42 Greater magnification of Fig. 38. *a* Torn mucosa, *b* necrosis and hemorrhage in the neighborhood of the oxyures, *c* the fecal mass between the oxyures in the mucosa.

longitudinal and one transverse section of the oxyures.

A further case examined showed the worms in the gland-tubes. This is seen as a longitudinal section of an oxyuris in a longitudinally cut gland tube as well as cross sections of both. Around the cross sections no more epithelium is to be seen and the glandular wall is consequently quite smooth while along the longitudinal sections of the gland tube we nevertheless still see a few remnants of the epithelial nuclei. This case showed

no noteworthy histological changes in the tissue, with the possible exception of a certain compression of the cells surrounding the glands (Figs. 23 and 24).

In the two cases first described it is easy to explain the destruction of the epithelium by the purely mechanical action of the oxyures, since only the epithelial cells directly in contact with the oxyures suffered destruction while those situated in the vicinity of the parasites but not adjoining the same remained intact. If this effect were produced



Fig. 43



Fig. 44



Fig. 45



Fig. 46



Fig. 47



Fig. 48

Fig. 43 *a*, Torn mucosa *b*, an oxyuris longitudinal section in the mucosa, greatly inflamed submucosa (*sb*), circular muscles (*cm*) and longitudinal muscles (*lm*)

Fig. 44 *a*, Destroyed mucosa *b*, oxyuris passage, which is connected with the lumen and contains a small fragment of oxyuris, *c*, a large longitudinal section of a female oxyuris in the lymphatic tissue in the neighborhood of the oxyuris there is necrosis and hemorrhage. Severe acutely inflamed submucosa (*s*) circular muscles (*cm*) and longitudinal muscles (*lm*)

Fig. 45 Greatly destroyed mucosa in the vicinity of the lymph nodules *a*, Oxyuris section in the cleft of the tissue

Fig. 46 Appendicopathy oxyurica traumatica. The epithelium is well preserved showing no inflammation *a*, Several oxyures in the lumen *b*, oxyuris in the

mucosa, *g*, oxyuris passage, *r*, a large previously formed space produced by a large diverticulum like indentation of the wall, partly destroyed by oxyuris.

Fig. 47 Continuation of series. The epithelium is well preserved, and no inflammation has occurred *a*, Oxyuris in the lumen *b*, oxyuris in the mucosa, this oxyuris communicates with the large space by means of a passage

Figs. 48 to 52 "Appendicopathy oxyurica traumatica". The epithelium is well preserved, but partly destroyed, there is no inflammation *a*, Oxyures in the lumen *b*, oxyuris in the act of penetrating into the mucosa, *c*, *d*, penetrating still further, *e*, the last position of the oxyuris in the vices, *h*, hemorrhage in the lumen *h'*, hemorrhage in the tissue surrounding the oxyuris

by a chemical noxa liberated by the parasite, as Rheindorf suspects the epithelium of an entire gland tube should in these cases have been affected (see Fig. 17)

3. *Oxyures which have penetrated the wall of the appendix*. The opinions of the various authors respecting the localization of the oxyures in the wall of the appendix are very different, indeed it is even a matter of controversy whether the oxyures are able to penetrate an intestinal wall that is entirely

normal. Since Wagner¹ in 1905 first demonstrated the presence of the oxyuris in the intestinal wall this problem has been variously explained by different authors. Schneider² had previously described a dead female oxyuris found in the pelvic peritoneum of a woman, but he was of the opinion that it had reached this site by way of the fallopian tubes,

¹ Wagner, Vinchow Arch. (Anat. u. path. Anat.) 1905, class. 145

² Schneider, Oxyuris vermicularis im Beckenperitoneum e. g. gekap. selbst. Zentralbl. f. Bakteriologie u. Parasitenk. 1904, xxviii, 539



Fig. 49



Fig. 50



Fig. 51



Fig. 52



Fig. 53



Fig. 54



Fig. 55



Fig. 56



Fig. 57

Figs. 53 to 64. Appendicopathia oxyurica traumatica with pronounced fissure formations and lymph nodule destructions.

Fig. 53. *a* A small oxyuris section, *c* a large fissure, *e* torn mucosa, *h* hemorrhage in the fissure, *f* destroyed lymph nodules, *s* a cleft to be considered an artifact which may, however, have been formed during the process of fixation. It is situated at the edge of the lymphatic tissue.

Fig. 54. Next in series Figs. 53 to 59.

Fig. 55. Same series. *a* Oxyuris in an extensive fissure with hemorrhage in the lymphatic tissue whose position corresponds to the arrow in the preceding illustration. Oxyuris fissure without any oxyures. At the same place in the next series an oxyuris is seen.

Fig. 56. Same series. *a* Oxyuris, *s* oxyuris cleft, *h* blood in the fissure, *h* hemorrhage in the tissue.

Figs. 57 to 59. Same series.



Fig 58



Fig 59



Fig 60



Fig 61



Fig 62



Fig 63

Fig 60 *a* Head end of an oxyuris, which has bored through a lymph node

Fig 61 Continuation of the series *a*, Oxyuris in the center of a lymph node *s*, destruction of the lymphatic

tissue, brought about by the oxyurids, *s'* fissure to be considered an artifact

Fig 62 and 63 Continuation of the series showing large defect in lymph node



Fig 64 The last in the series. No oxyurids are to be seen. This fissure nevertheless represents destruction of the lymph nodes effected by the oxyurids

for Heller¹ had found an oxyuris in the fornices of the vagina, Simons² found two

¹ Heller Über Oxyuris vermicularis. Deutsch. Arch. f. klin. Med. 1903. LXXIV. 21

² Simons Entozoen in der Gebärmutter. Zentralbl. f. Gynäk. 1899

specimens in the cervical canal, Vix saw eggs of the organism in the uterus, and Marro³ found numerous oxyuris eggs in a fibrous cyst situated on the fallopian tube. Hueck's investigations suggest that the oxyuris may even have reached the submucosa; but he has at no time seen sections of the organism in the muscularis, nor found any records of such findings in the literature.

In contradistinction to the above named authors, Hippicus and Lewison write as follows: "At one place the bodies of the oxyuris are only separated from the serosa by means of a thin layer of fiberlike connective tissue." In his recent communication Rheindorf⁴ stated that as no inflammatory processes of

³ Marro Cited in the Ref. in Zentralbl. f. Bakteriologie u. Parasitenkunde, 1902, XXXI

⁴ Rheindorf Ist die Oxyuris vermicularis im stande aktiv die Protoplasma wand zu durchdringen, und ist sie ein blutausgender Parasit? Zentralbl. f. Bakteriologie u. Parasitenkunde, 1914 LXXIV. Part I

note were found in the vicinity of the oxyures, it was conceivable that the organisms had in the case mentioned by him burrowed their way actively through the musculature.

It is of course conceivable that the oxyuris is able to penetrate the appendix wall as far as the serosa by way of the previous pathologically initiated perforation. Whitelocke¹ has recently reported a case in which the abdominal cavity at operation was seen to contain a dozen dead oxyures, together with a quantity of putrefactive and semipurulent fluid; the organisms were covered with omentum. In addition the small pelvis was seen to contain four living oxyures, the processus was inflamed and showed a small perforation, from which during the operation emerged several more worms. We are unable to know whether this was a case of active penetration of the oxyures, for the appendix in question was not examined microscopically. Thus, it is a difficult matter to decide whether perforation in appendicitis is primarily caused by the penetration of the oxyures, or whether the reverse is true; viz., that the oxyures penetrate a perforation already formed.

My own investigations may here be appropriately quoted. In one case, an oxyuris was found in the act of penetrating the mucosa with its head. Under a low power microscope the section suggests a depression-formation, but under a more powerful lens the mechanical destruction of the tissue at this point can be seen. As already mentioned, depression formation never results in the destruction of tissue, but in such cases the wall always remains smooth. The site of the perforation was between the two gland-tubes (Fig. 25).

Sometimes the oxyuris lies superficially on the mucosa immediately under the epithelium (Figs. 26, 27, 28, and 29), at other times it lies deep down in the lymph nodes, extending to the vicinity of the submucosa (Fig. 30). In one case I found a specimen of oxyuris which was boring its way from the lumen into the lymph-nodules (Figs. 31 and 32). This preparation shows a longitudinal section

of the anterior part of the oxyuris; the muscularis mucosæ has been completely bored through, and the head end of the organism has reached the lymph-nodules in the vicinity of the submucosa. It is of especial note to observe that the edge of the walls of the mucosa toward the oxyuris is quite smooth and that neither important traumatic destruction, nor inflammatory changes, nor yet hæmorrhage are to be seen in the tissue, all that may possibly be noted is a certain degree of nuclear disintegration in the cells situated at both edges of the duct. The preparation shows a fairly broad space between the worm and the tissue wall, which, however, was produced by the shrinkage of both oxyuris and tissue upon fixation. This leads one to think that before fixation took place there was no space at all, and that the oxyures were consequently in close contact with the tissue.

In my investigations I have never seen cases in which the oxyuris actively bored its passage through the musculature of the intact processus, although, this was often found to have occurred in the mucosa and, according to Hueck, in the submucosa as well.

Rheindorf's illustration shows a large muscular defect with a torn wall, filled with faecal matter, the oxyuris is embedded in the faeces. A small portion of a worm is also seen in the faeces on the peritoneum. Owing to the total absence at the borders of the duct of any inflammatory infiltration and of phlegmonous inflammation of the layers of the wall, Rheindorf feels justified in assuming that this muscular defect was produced by active penetration of the oxyuris. But in my own preparations the wall of the duct is invariably smooth.

This problem may be explained in the following manner: The oxyuris in the case of an absolutely normal appendix usually bores actively through the mucosa, sometimes as far as the submucosa, but in a normal appendix we can only admit of active penetration of the entire musculature when a specimen of the organism is found, together with a smooth wall, as seen in my illustration.

The above described data taken from my personal observations permit me to affirm with certainty that in post-mortem material the oxyures are found in the lumen, the gland-

¹ Whitelocke. A case of mulcting meningitis in which the symptoms were caused by the escape of threadworms into the peritoneal cavity through a perforated appendix vermiciformis. Brit. J. Child. Dis. 1913, 3: 296.

logical picture, for which reason they will be denominated "appendicitis oxyurica." But it should here again be emphasized that this type of the disease occurs but rarely, and in the 103 cases examined by myself but one such example was found, although the organisms are found fairly often in the inflamed appendices.

c Oxyures as the cause of a non-inflammatory disease of the appendix. In three subjects, from whom the appendices were removed on account of the clinical conditions resembling appendicitis, I found that a peculiar change had occurred, viz., extensive destruction of the mucosa without any sign of inflammation.

CASE 1 (Fig 46) The illustration shows five specimens of oxyuris in the lumen, which contains no faecal matter, but only a certain amount of mucus. The epithelium of the mucosa is well preserved. There is a pronounced defect in the mucosa, the edge of which is in part covered over with epithelium, and this defect communicates with the lumen by way of a narrow passage. The latter has doubtless been produced by the oxyures. The lymphatic tissue by the side of this large defective place is seen to be filled with a section of an oxyuris. This may lead one to think that the oxyuris had penetrated from the lumen into the lymph nodules through the narrow passage and the large defects, but I do not think that the entire space of these defects was formed by the worm, as the wall of the same was partially covered over by epithelium. Upon examination of the appendix one sometimes finds a diverticulum like physiological depression of the mucosa. This fact enables us to understand the nature of this space. The oxyuris has penetrated through the narrow passage into the depression already present and after destroying a part of the same has entered the lymph nodule.

In the following series of sections (Fig 47) the passage is no more visible, but here the oxyuris section in the lymph nodule is seen much more distinctly than in the previous illustration, and on one side of the large space is seen a row of well preserved epithelium, while in the remaining part of the same no epithelium is visible. Rheindorf hinted that such a formation of the mucosa in the fissure was a case of regeneration, but I believe that if such were the case the scar formation would be seen.

In addition to these traumatic disturbances of the mucosa a certain amount of old hæmorrhage is visible in the neighborhood of the oxyuris, but apart from this there is no noteworthy change and no inflammation. Thus it is conceivable that in this case the passage and the defects were much smaller before fixation than they appear in the preparation.

CASE 2 (Figs 48 to 52) In the first section of the series, we find two worms in the lumen of the appendix surrounded by blood, no faecal matter is present and the epithelium is well preserved. The next section shows an oxyuris in the act of penetrating the mucosa and in the remaining series the worms in the lymph nodules are seen almost to have reached the submucosa. It is especially noteworthy that the blood is found not only in the lumen, but also in the tissue of the submucosa in the neighborhood of the oxyures. In the entire series of sections no trace of inflammation is seen.

It is of course possible that such a bleeding occurs traumatically during operation, but I believe that it is provoked by the oxyures, as this site corresponds to the middle of the appendix and no blood can be seen in the remaining part of the process. It is inconceivable that during operation a circumscribed focus of hæmorrhage can be produced confined to that part in which the oxyuris is harbored, and that it can be produced nowhere else.

CASE 3 (Figs 53 to 64) In this case we clearly see the extensive destruction of the mucosa brought about by the oxyures. The lumen contains neither oxyuris nor faeces, but only mucus is seen. The epithelium is well preserved. In the first series can be seen a large fissure with hæmorrhage in the lymphatic tissue of the mucosa, beside which is a small oxyuris section. The edge of this fissure is in part sharply outlined and in part irregularly torn. In the other series the oxyures are found in the lymph nodules which were greatly injured by the worms. At the site of the oxyures a fissure has been formed, accompanied by hæmorrhage, the wall of the fissure in the lymph-nodule is for the most part torn. The last of the series shows a large defect in the lymph nodule where there is no remaining part of the oxyuris, but this is an oxyuris fissure. If this series be compared with the preceding section we are at once able to understand that it is a lymph nodule which has been destroyed by the oxyures. Close to this large fissure there are some more smaller clefts with hæmorrhage, which must be considered as cases of tissue destruction produced by the organisms, as they are accompanied by bleeding, which does not occur in fissures due to artefacts.

From the consideration of this specimen I was able to ascertain that pseudo-appendicitis could be provoked by the oxyures even without the incidence of inflammation. Hueck already designated a painful pathological condition of the appendix, other than appendicitis, by the name "appendicopathia oxyurica," but among the 18 cases examined by him he found the parasite but once in the

mucosa and submucosa, it was usually found only in the lumen. It is doubtful whether the organisms when situated in the lumen are indeed able to produce a morbid condition similar to appendicitis without the accompaniment of any demonstrable anatomical changes. My own experience leads me to believe that an individual can, with impunity, harbor the organisms in the appendix, without the necessary accompaniment of any abnormal symptoms. It was especially important to note that in post-mortem material the oxyures were situated in the wall of the process, without any demonstrable histological changes having been effected; whereas in the cases of extirpated appendices extensive traumatic destruction was always present. In women, especially, we often find morbid appendicitis like conditions, unaccompanied by infection or by the presence of oxyures.

Of course it is absolutely impossible to discover whether a given pain has been caused by the presence of oxyures in the lumen.

Since I could always demonstrate in my cases a traumatic destruction of the mucosa accompanied by hemorrhage, I will designate such a case by the name of "appendicopathia oxyurica traumatica."

What is the reason, then, that in the surgically extirpated appendices we invariably find traumatic changes, while in the post mortem material no reaction is seen around the oxyures? It appears that this circumstance is connected with the life energy of the parasite. If the worm remains inserted in the gland tube or if, after having penetrated to the mucosa, it ceases all violent movement no demonstrable changes occur and in such cases all clinical symptoms remain absent.

SUMMARY

1 In an appendix the oxyures may be harbored, not only in the lumen but also in the mucosa and submucosa, this may occur without producing any clinical symptoms or any noteworthy anatomical changes.

2 We sometimes encounter a case in which an appendix infected with oxyures is inflamed through a totally different agent. For this reason the origin of appendicitis can not be attributed to the worms, although these

parasites have been found in an inflamed appendix. In the majority of cases the presence of the oxyures in cases of appendicitis, whether it be chronic or acute, is to be considered as a pure accident.

Rheindorf always attributed too great importance to infection caused by oxyures. His statement to the effect that all cases of appendicitis or pseudo-appendicitis are to be attributed to oxyuris infection, appears to me to be inaccurate.

3 I was able to ascertain that a true inflammation is provoked by the parasites when the latter have penetrated the wall of the appendix in large numbers, and that the traumatically destroyed fissure in the tissue is for a protracted period of time in connection with the lumen, thus offering the infecting agent a portal of entry. This type of the disease offers us distinct histological data, for which reason I have designated it "appendicitis oxyurica." But this type of the disease is only rarely met and among 103 surgically extirpated appendices I met but one such case.

4 A non-inflammatory, but pain-producing morbid condition of the appendix is sometimes caused by the oxyuris, in which cases traumatic destruction of the tissue accompanied by hemorrhage can always be demonstrated. It is very much to be doubted whether oxyures which are merely situated in the lumen are able to cause this painful condition, without any accompanying anatomical changes.

Among the 103 above quoted cases I found three cases of this type.

5 From my investigations I am able to affirm with certainty, that a part of the oxyuris passage and cleft of which Rheindorf speaks and several fine fissures in the lymph nodules seen in his illustrations, as well as certain defects at the edge of the mucosa, where no oxyures are to be found, are to be looked upon as artefacts. But on the other hand Aschoff is, in my opinion mistaken in considering every oxyuris passage and fissure to be purely artificial in origin, since the evidence of my own preparations, presented in this paper must lead one to admit that an undoubted cleft is occasionally formed by the parasite.

METHODS EMPLOYED FOR DETERMINING THE HYDROGEN-ION CONCENTRATION IN BODY FLUIDS

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PRESENT interest in the problems of acid production and control within the body, and in the known clinical concomitants of acid intoxication constitutes a sufficient excuse for these notes on devices employed for the measurement of the hydrogen ion concentration (true acidity) in physiologically important fluids. This is especially true since many recent improvements in technique have not been made available in collected or easily accessible form. Some understanding of purely physicochemical matters is essential for the proper appreciation of these methods and, indeed for the interpretation of the results as well. Progress has recently been made however, in the development of methods which are at once rapid, easily carried out, and sufficiently accurate for certain kinds of routine work.

The results which have been secured in this field are of considerable interest to the physiologist but in some respects their possible practical significance has yet to be established.

It is not possible to give in this place any summary of the published hydrogen ion concentration measurements relating to body fluids. The recent monograph of Michaelis (1) is very complete up to the time of its publication and references will subsequently be made to other and more recent articles.

These notes refer mainly to the technical procedures which we are using in the laboratory of Dr. G. W. Crile for the study of problems concerning acidosis.¹ Except in regard to some details nothing original is claimed for these methods but because they have proved most useful in several months' continuous work necessitating a large number

of hydrogen ion determinations, it is hoped that they may be of service to others.

A word is perhaps required regarding the notation used in recording hydrogen ion concentrations. It is customary to express these values in a convenient way suggested by Sorensen, namely by the *logarithm* of the hydrogen ion normal (C_H), with the negative sign omitted; this is denoted by the symbol P_H . Inasmuch as we are dealing with ionic concentrations which are far below normal, this exponent P_H is negative, and an increase in P_H denotes a decrease in the hydrogen ion content. This may be illustrated by the figures in Table 1, which also serves to show the comparatively large significance of small variations in P_H .

TABLE 1

$\frac{1}{(H)} \times 10^{-7}$	P_H
0.1993	7.70
0.2512	7.60
0.3162	7.50
0.4000	7.40
0.6309	7.20

It is, also, not out of place to call attention briefly to the possible significance of the hydrogen ion content of body fluids and the variations in this value. Evidence has been found and is rapidly being increased, which shows that the activity of the respiratory center is controlled by the P_H of the blood, in its turn normally determined by the concentration of carbonic acid. It is further quite possible² that the hydrogen-ion unites directly with the hemoglobin molecule, thus interfering with oxygen transportation, in addition to affecting the physical condition of hemoglobin in other ways. More important than this in some respects, is the known dependence of the activity of enzymes upon the P_H of their media, since there has recently been opened up the complex possibility that the action of enzymes, and conceivably of

¹ Acidosis is a much abused word in fact one incapable of exact definition in view of the diverse and frequently very vague usages to which it has been subjected. Probably the best working idea of acidosis may be obtained from the paper of Halden and Henderson (2) wherein it is proposed to consider that a condition of acidosis exists when the bicarbonate depletion of the blood has been carried to such a point that the addition of a quantity of sodium bicarbonate equivalent to 1 liter of a 10% solution fails to diminish the urinary acidity.

² Cf. Harellot, J. 1914. The Respiratory Function of the Blood (Camberidge) p. 316.

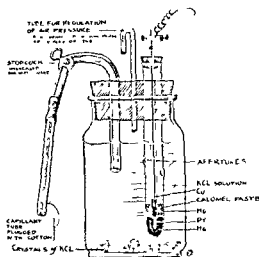


Fig. 1 Barendrecht's electrode

hormones also is the result of a balance between the "active agent" itself and various inhibitors, it should be taken into account that irregularities in P_H may be responsible for various abnormal manifestations of enzyme or hormone effects. Linked with this matter is the further probability that hydrogen ion variations result in changes of the aggregation condition of the colloidal materials of cell membranes thus being implicated in important modifications in the permeability of cells.

1 The gas electrode The fundamental method of acidity determination is based upon the fact that the potential developed at the contact of gaseous hydrogen with a solution containing the hydrogen ion is dependent among other things upon the concentration of the hydrogen ion within that solution. Under controlled conditions it is possible to calculate the hydrogen ion concentration from the measured potential of a "gas electrode" of which the essential constituent is a layer of colloidal platinum black usually deposited on a Pt wire (or on glass) which is saturated with hydrogen² and part of which is immersed in the solution being studied. This electrode forms one "leg" of a battery, the other limb being most usually a calomel

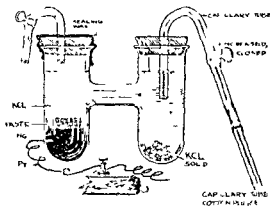


Fig. 2 New form of electrode

electrode containing KCl as electrolyte. The potential of this battery is then measured by the compensation method using resistance boxes and a capillary electrometer of the enclosed (Luther) type. As the source of compensating electromotive force a lead accumulator or a couple of dry cells may be employed. The value of this opposing electromotive force is found by comparison with a Weston normal cell.³

The two points requiring most delicate consideration are the calomel electrode and the hydrogen element. Many types of calomel electrode have been suggested but we are finding most serviceable two forms which differ slightly from the ones pictured in many textbooks. The first of these is that designed by Barendrecht (4) and the second is a form of electrode, which has proved even more generally satisfactory (see Figs. 1 and 2) constructed with the H vessel familiar in standard cells. These electrodes have an especial advantage for electrometric titrations. It is best for routine work to use the saturated KCl calomel electrode, a tabular statement of its characteristics will be found in Michaelis' book (1). It is very convenient to have two calomel electrodes which may be used alternately in duplicate determinations. The calomel electrodes may be standardized either by comparison with a "null" electrode,

² It is known that variations in P_H accompany the coagulation of proteins and other colloidal solutions (cf. Walpole 3).

³ This combination acting like a conducting form of H_2 .

⁴ For the technical details of these procedures see Emley's Practical Physical Chemistry or Michaelis (1).

All connecting wires should either be shielded with glass tubing, or have the insulations grounded. This is to avoid the very shadowy effects of stray currents.

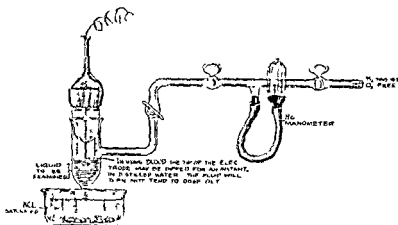


Fig 3 Hydrogen electrode, modified from Walpole

or, more conveniently, against solutions of known P_H . It is possible to construct also curves relating the resistance in the hydrogen battery circuit when it is exactly balanced to the P_H at a given temperature. These curves are useful in a double way, namely, in standardizing the electrode and in affording a very decided short cut in the calculation of P_H in "unknowns".

With physiological fluids the loosely contained CO_2 is a very considerable source of error in hydrogen ion determinations, since it may so easily be lost by exposure to the air or by the bubbling through of hydrogen or other gases. Several more or less laborious schemes have been devised to overcome a possible increase in alkalinity (of blood, for example), by the loss of CO_2 . By far the most practical of these methods is that suggested by Michaelis, namely the use of a small stationary volume of hydrogen with minimum contact between the platinized electrode and the solution which is being analyzed.¹

The small contact surface between platinum and solution assures that only a small volume of blood must be reduced. The reduction is essential if one is to avoid oxidation potentials which interfere decidedly with the readings of electromotive force for the gas cell. Michaelis' electrode is very useful for work on blood, but the Walpole (5) electrode is very much less cumbersome and more

generally handy for determinations on many kinds of fluids. It is believed better to substitute for the plunger, which Walpole uses for filling, a manometer attachment. (Fig. 3).²

The connection between the gas and calomel electrodes is best made through a saturated KCl bath,³ or, in many instances, the cotton filled tube of the KCl calomel electrode may dip directly into some of the fluid which is being analyzed.

Having measured the potential of the hydrogen battery the hydrogen-ion content is calculated from Nernst's formula —

$$\pi_p = \pi_o + 0.0577 \log \frac{C_o}{C_p}$$

π_p = electromotive force of "unknown" fluid
 π_o = electromotive force of the normal hydrogen electrode

The value of π is substituted corresponding to the temperature at which the measurements are being carried out and C_p may then be calculated. P_H may be obtained from the expression

$$P_H = \frac{\pi_o - 0.5177}{0.0577} \quad (\text{at } 18^\circ \text{C})$$

II Indicators The use of indicators for hydrogen ion estimations is open to at least three sources of error, namely, the influence of neutral salts or amphoteric proteins, and of the color and opacity or turbidity of the fluids examined. Without going into many

² Baren brecht a gas cell has not in our hands, proved satisfactory

³ I or the retical reasons which cannot be treated of in this place

¹ See Walpole (6)

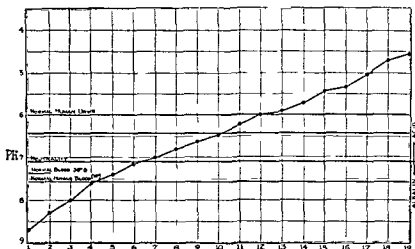


Fig. 4 Chart for $[H^+]$ estimation — 18° The solution number is shown at bottom of chart

details, it is sufficient to say that, with a properly prepared set of standards for comparison, it is possible to utilize indicators for the estimation of the P_H of urine, blood, cerebrospinal fluid, bile, milk, and various other aqueous solutions. The wide application of the indicator method is made possible by dialysing against an appropriate fluid such things as blood, milk, and the like, to which the indicators may not be directly applied.

A Direct use of indicators This method has been successfully applied by Henderson (2) and others to the study of acid excretion in urine. We find (see subsequent tables) that it may also be used for the determination of P_H in cerebrospinal fluid.

The indicators we employ are two

1. Sodium alizarin sulphonate (2 per cent solution).

2. Phenolsulphonaphthalein (0.6 per cent solution).

These indicators are used in combination, one drop of each in the tubes of the standard set and in the "unknown", test tubes of uniform caliber are used as containers. The solutions of known P_H are given in Table II, 5 ccm. of each of these is diluted in a test tube to about 15 ccm. after the addition of the indicators. The indicators are added from pipettes used throughout for this purpose. The indicators may be kept mixed and the drop added from a stalagmometer. It is

essential, or at least very desirable, that these standards be checked by gas chain determinations. The set of comparison tubes is stable for some days. The standard stock solutions are stored in hard glass flasks. Two cubic centimeters are sufficient for an analysis, the dilution reducing to a minimum the error from neutral salts and the color of urine.

TABLE II

Solutions — Designation	Component	Concentration
A	Sodium acetate ($NaC_2H_3O_2 = 3H_2O$)	N/5 (27.20 gms. liter)
B	Acetic acid	N/5
C	Disodium phosphate ($Na_2HPO_4 = 12H_2O$)	N/10 (17.8 gms. liter)
D	Monopotassium phosphate (KH_2PO_4)	N/10 (13.6 gms. liter)
Solutions (Proportions make up to 50 cc. +, dilute to 250)		
1	0.5 ccm. (d) + 240 ccm. (c)	P_H 8.7
2	0.7 ccm. (c) + 0.3 ccm. (d)	8.3
3	0.5 ccm. (d) + 60 ccm. (c)	8.00
4	0.9 ccm. (c) + 1 ccm. (d)	7.60
5	5 ccm. (d) + 25 ccm. (c)	7.40
6	7 ccm. (c) + 3 ccm. (d)	7.15
7	5 ccm. (d) + 11.5 ccm. (c)	7.00
8	5 ccm. (c) + 5 ccm. (d)	6.80
9	4 ccm. (c) + 6 ccm. (d)	6.63
10	3 ccm. (c) + 7 ccm. (d)	6.40
11	2 ccm. (c) + 8 ccm. (d)	6.23
12	1.5 ccm. (c) + 8.5 ccm. (d)	6.00
13	1 ccm. (c) + 9 ccm. (d)	5.92
14	1 ccm. (b) + 10 ccm. (a)	5.74
15	1 ccm. (b) + 7 ccm. (a)	5.45
16	1 ccm. (b) + 4 ccm. (a)	5.35
17	1 ccm. (b) + 2 ccm. (a)	5.05
18	1 ccm. (b) + 1 ccm. (a)	4.74
19	1.5 ccm. (b) + 1 ccm. (a)	4.57
(Av. = 0.25 per step)		

A graph illustrating the P_H values of the standard solutions is appended (Fig 4). The curve serves a special purpose, in that it is found possible, after some practice, to interpolate with a very fair degree of accuracy when the "unknowns" do not exactly coincide with any of the comparison tubes.

It is worth while to call attention to the fact that this indicator series in combination with the use of two indicators affords a scale of colors which shows good differentiation between the several steps in the series over a wide range of P_H values.

B. Dialysis Notes on dialysis as applied to hydrogen-ion concentration estimation in blood, bile, turbid urine, etc

Dialysis membrane—collodion sacs A satisfactory membrane for the procedure has been prepared as follows. A 10 per cent collodion¹ (E Schering) is made by dissolving 10 gms of the collodion in ether 50 ccm and ethyl alcohol 50 ccm complete solution being obtained in 48 hours. Allow the preparation to stand, agitating at intervals.

About 2 to 3 ccm of the collodion solution is poured into a good sized test tube, the tube held horizontally and rotated slowly until the entire inside of the tube is coated. The test tube is then inverted and any excess of collodion allowed to run out. The tube is held inverted in the hand until the ether is driven off and then reversed and filled with warm water. This step seems to be one of the most important in the technique, because if left to dry too long the membrane is hard, brittle and more impervious. If immersed too soon the sac is thick, opaque and not tough, and may even contain bubbles. The point of time at which it is best to immerse the preparation may conveniently be determined by the odor from the tube. Just when ether can no longer be detected and alcohol begins to come off, the tube should be filled with warm water and allowed to stand for a minute. The sac may then be very gently separated from the inside of the glass. A very thin, transparent, rather tough, permeable membrane will be obtained. The sacs are kept immersed in a jar of distilled water until used.

Five to ten cubic centimeters of the solution to be dialysed is placed in one of these membranes, which is then lowered into a short tube of large diameter, containing about 15 cubic centimeters of normal saline solution at body temperature. The whole is then kept at 37° C. for about five minutes, the dialysate poured off, and the determination made after cooling to room temperature. The readings made by two separate workers have been found to correspond very accurately with those made with the gas chain.

As found by Rowntree (7) either whole blood or serum may be used, readings being the same. For the dialysis of milk, turbid urine, etc., distilled water may be used in the outer tube.

III The oxyhaemoglobin dissociation curve as an index of acidosis (Barcroft method). An indirect method of estimating the alkalinity of the blood, or rather of detecting the existence of acidosis, has recently been employed by Barcroft and his co-workers. This is based upon the fact that the affinity of reduced haemoglobin for oxygen is dependent upon the reaction of the blood, being decreased with increasing acidity, probably as the result of direct interference on the part of the hydrogen ion with the oxygen fixing power of haemoglobin. A condition of acidosis exists when the blood has less than its usual (normal) affinity for oxygen (meionexy). The degree of meionexy is expressed by the value of the mass action constant (K) in Hill's equation for the dissociation curve of oxyhaemoglobin. This figure K varies inversely with the acidity. In practice this method is attended by several difficulties, which interfere with its routine use in the hands of people unskilled in gas analysis. A small sample (1 to 2 ccm) of the blood to be examined is shaken at body temperature in a closed vessel (tonometer) containing known partial pressures of nitrogen, oxygen, and carbon dioxide, the latter being present at a tension equal to that found on analysis of the alveolar air. The blood sample is then analyzed for O₂ saturation by the differential method (see Lewis, Ryffel, Wolf, Cotton, and Barcroft, 8).

The method has been applied to the esti-

¹ It is important that the collodion be neutral, or as neutral as possible.

ration of the acids is due to non-volatile acid on the basis of comparisons with O_2 acidity measurements upon CO_2 free blood to which various quantities of lactic acid had been added. In this case the technique is the same as in the preceding except that the O_2 saturation is estimated in the presence of a known (constant) tension of O_2 in the absence of CO_2 . The non-volatile acid is calculated as lactic acid.

This procedure yields figures which show more variation in the value of K than has been obtained in direct gas chain measurements of P_a . The two types of analysis are, on practical grounds, somewhat difficult to compare, for reasons which may not be gone into here. For example, Lewis and Barcroft record values of K in cardiac dyspnea which, on the basis of Peters' measurements of the relation of P_a to CO_2 tension in normal blood (Barcroft), may be calculated to correspond to P_a (at 37°) = 8.93, 7.14, 7.12, etc.

Now a large number of carefully executed determinations have been carried out upon the reaction of the blood in a variety of diseases, and aside from a variation which is readily accounted for on the basis of individual peculiarity there are only a very few

instances in which P_a varies by a notable amount from the mean 7.32 (35°) given by Michaelis and those in which the conditions similar to those studied by Barcroft (and Lewis) the variation is so great as that indicated above.

There seems very little doubt that this method affords a valuable index of acidification, whether or not it gives the true hydrogen ion concentration in blood, but the nature of the technique prohibits its very general use.

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END RESULTS IN 242 CASES OF SIMPLE FRACTURE OF THE FEMORAL SHAFT

CHART I. END-RESULTS IN SIMPLE FRACTURE OF FEMORAL SHAFT

No	Name	Age	Sex	Date of fracture	Location	Primary Shortening	Treatment	Duration of Extension	Bed	Cast	Cane	Condition at Discharge	Present Condition
1	T. P.	2 yrs	M	6-23-10	Upper and middle 1/3	0	Buck's extension overhead	6 wks	6 wks	0	0	No shortening of motion	Complete recovery
2	R. C.	3 wks	F	7-3-11	Center of femoral shaft	0	Plaster cast	4 wks	4 wks	0	0	No shortening of motion	Complete recovery
3	M. J.	9 mos	F	2-9-07	Junction of upper and middle 1/3	0	Buck's extension overhead	5 wks	5 wks	0	0	No shortening of motion	Complete recovery
4	P. F.	7 mos	M	5-1-13	Middle of femur	0	Buck's extension overhead	4 days	4 days	0	0	No shortening of motion	Complete recovery
5	P. A.	2 yrs	M	5-9-12	Lower end of upper 1/3	0	Buck's extension overhead	3 wks	3 wks	Cast 2 wks	0	Cast for 4 weeks	Complete recovery
6	C. G.	15 yrs	F	2-17-10	Lower 1/3 right femur	0	Plaster cast	4 wks	4 wks	0	0	Cast on	Complete recovery
7	T. G.	14 mos	M	12-25-09	Lower 1/3 right femur	0	Buck's extension overhead	3 wks	3 wks	0	0	Good union no shortening	Complete recovery
8	A. S.	2 yrs	M	9-24-13	Upper 1/3 right femur	0	Buck's extension	7 wks	7 wks	0	0	No shortening of motion	Complete recovery
9	M. A.	2 yrs	F	8-15-06	Supracondylar	0	Buck's extension above	5 wks	5 wks	0	0	Complete recovery	Complete recovery
10	L. H.	15 yrs	F	3-1-08	Middle of shaft	0	Buck's extension and cast (by operation)	5 mos	5 mos	2 days	0	No shortening of motion	Complete recovery
11	G. H.	2 yrs	F	4-12-08	Middle 1/3 right femur	0	Buck's extension	5 wks	5 wks	1 day	0	No shortening of motion	Complete recovery
12	A. F.	4 mos	M	9-9-07	Juncture of upper and middle 1/3 femoral shaft	0	Plaster cast	0	0	0	0	Cast on	Complete recovery
13	R. J.	2 yrs	F	9-14-10	Single green stick	0	Plaster cast	6 wks	6 wks	0	0	Same length	Complete recovery
14	J. D.	2 yrs	F	11-1-07	Upper and middle 1/3 right femur	0	Buck's extension	13 days	13 days	0	0	Good firm union considerable angulation	1 1/2 in short Right leg paralyzed (reflex) Braces no shortening Jaws or tenderness
15	P. G.	7 yrs	M	5-14-13	Lower 1/3 right femur	0	Buck's extension	6 wks	6 wks	2 day	2 days	Crutches	Complete recovery
16	J. F.	3 yrs	M	7-6-12	Middle of shaft of right femur	0	Buck's extension	6 wks	6 wks	0	0	Weakness, no shortening	Complete recovery
17	M. C. D.	5 yrs	M	3-31-06	1 1/2 per 1/3 left femur	0	Buck's extension	7 wks	7 wks	1 day	0	Weakness no shortening no limitation of motion	Complete recovery

18	G J	6 yrs	M	10-5-11	Supracondylar	0	Buck's extension	7 wks	7 wks	1 day	0	0	Weakness, no shortening	Complete recovery
19	E H	7 yrs	M	11-5-09	Lower $\frac{1}{3}$	0	Buck's extension	6 wks	6 wks	0	0	0	Weakness no shortening	Complete recovery
20	J R	7 yrs	M	7-5-10	Middle right femur	0	Buck's extension	8 wks	8 wks	0	0	0	Weakness no shortening no stiffness	Complete recovery
21	I F	7 yrs	M	1-1-07	Lower end upper $\frac{1}{3}$	0	Buck's extension	7 wks	7 wks	0	0	0	No shortening no limitation of motion	Complete recovery
22	B B	11 yrs	F	11-11-11	Middle right femur	0	Buck's extension	6 wks	6 wks	1 day	2 wks	1 wk	Crutches Weakness no shortening	Complete recovery
23	M G	6 yrs	M	10-20-07	Upper end lower $\frac{1}{3}$ right femur	0	Buck's extension	7 wks	7 wks	0	0	0	Good no shortening	Complete recovery
24	W W	4 yrs	M	9-15-11	Lower end upper $\frac{1}{3}$ right femur	0	Buck's extension	6 wks	6 wks	1 day	0	0	No shortening, no limitation of motion	Complete recovery
25	A I	5 yrs	F	1-15-13	Lower $\frac{1}{3}$	0	Buck's extension	11 wks	11 wks	1 day	0	0	Weakness no stiffness no limitation of motion	Complete recovery
26	A K	10 yrs	M	5-15-11	Lower $\frac{1}{3}$ femur	0	Buck's extension	3 wks	3 wks	0	2 wks	0	Cast no shortening	Complete recovery
27	T M	10 yrs	M	7-10-09	Middle of shaft	0	Buck's extension	7 wks	7 wks	1 day	0	2 wks	Crutches no shortening no limitation of motion	Complete recovery
28	P I	9 yrs	M	3-1-09	Upper end lower $\frac{1}{3}$ femur	0	Buck's extension	5 wks	5 wks	1 day	0	2 wks	No shortening, no limitation of motion	Complete recovery
29	M S	7 yrs	F	12-23-06	Lower end upper $\frac{1}{3}$ femur	0	Buck's extension	7 wks	7 wks	2 days	1 mo	0	Crutches and cast	Complete recovery
30	F G	8 yrs	M	6-20-11	Middle left femur	0	Buck's extension	6 wks	6 wks	0	0	0	No shortening, no limitation of motion	Complete recovery
31	S R	6 yrs	M	11-21-06	Shaft right femur	0	Buck's extension	7 wks	7 wks	0	0	0	Some weakness no shortening	Complete recovery
32	A B	4 yrs	M	6-15-13	Transverse fracture middle shaft right femur	$\frac{1}{2}$ in	Cast for 3 months Buck's extension	4 wks	7 wks	0	0	0	Walked well	No shortening, Complete recovery
33	A N	9 yrs	M	5-20-05	Transverse fracture middle and upper $\frac{1}{3}$ left femur	$\frac{1}{2}$ in	Buck's extension	8 wks	8 wks	2 days	3 days	0	Crutches '1, in shortening	Complete recovery
34	H D	7 yrs	M	2-2-06	Juncture middle and lower $\frac{1}{3}$	0	Buck's extension	8 wks	8 wks	0	0	0	O.K. No shortening	Complete recovery
35	F I	11 yrs	M	11-19-13	Middle $\frac{1}{3}$ right femur	$\frac{1}{2}$ in	Plaster cast	0	1 wk	3 wks	0	2 wks	No shortening weakness no limitation of motion	Complete recovery
36	A F	5 yrs	M	9-10-07	Middle $\frac{1}{3}$ femur	0	Buck's extension	4 wks	4 wks	0	0	0	No shortening walked with limp	Complete recovery
37	W R	4 yrs	M	7-1-10	Middle $\frac{1}{3}$ femur	0	Buck's extension	5 wks	5 wks	0	0	0	No shortening walked with limp	Complete recovery
38	F B	10 yrs	M	11-17-10	Upper $\frac{1}{3}$ of shaft of left femur	0	Buck's extension	10 wks	10 wks	1 day	1 wk	0	Crutch no shortening	Complete recovery
39	J L	9 yrs	M	6-23-09	Middle of shaft of right femur	0	Buck's extension	5 wks	5 wks	0	0	0	Walked out No shortening no limitation of motion	Complete recovery

61	J. A.	9 yrs	M	6-11	Fracture of upper and middle $\frac{1}{3}$	$\frac{1}{4}$ in	Buck's extension	8 wks	0	0	Weakness no shortening	Complete recovery	
62	L. P.	5 yrs	M	6-10-13	Older fracture lower $\frac{1}{3}$ shaft of right femur	$\frac{1}{2}$ in	Buck's extension	7 wks	3 days	Cast 7 wks	Cast $\frac{1}{2}$ in shortening	Complete recovery, slight lameness	
63	H. W.	4 yrs	M	8-10-13	Middle of shaft of left femur	0	Buck's extension	7 wks	0	0	No shortening could not walk well	Complete recovery	
64	G. A.	12 yrs	M	11-17-09	Lower $\frac{1}{3}$ right femoral shaft	0	Buck's extension	5 5 wks	5 5 wks	3 mos	Crutches, plaster cast (3 wks)	Complete recovery	
65	E. T.	5 yrs	M	8-15-11	Middle	0	Buck's extension	7 wks	0	0	Could not walk	Complete recovery	
66	L. W.	7 yrs	M	10-13-10	Lower $\frac{1}{2}$ right femur	0	Long axis extension in short in femur and posterior and split	3 wks	5 5 wks	7 days	Crutches	Complete recovery, except pain damp days	
67	J. G.	11 yrs	M	9-11-06	Upper $\frac{1}{3}$ right femur	$\frac{1}{2}$ in	Buck's extension	2 5 mos	2 5 mos	6 days	1 mo	Complete recovery	
68	M. J.	7 yrs	F	3-7-13	Left femur supracondylar	0	Buck's extension	9 wks	0 wks	0	Crutches $\frac{1}{2}$ in shortening	Complete recovery	
69	R. D.	3 yrs	M	6-5-13	Middle of left femur	0	Buck's extension	7 wks	7 wks	0	Good No shortening some weakness	Complete recovery	
70	A. F.	7 yrs	M	8-9-08	Lower $\frac{1}{3}$ of shaft of left femur	0	Buck's extension	12 wks	12 wks	2 d 1/2	6 mos	Plaster cast and crutches no shortening	Complete recovery
71	E. B.	5 yrs	M	9-5-09	Upper $\frac{1}{3}$ of shaft of right femur	0	Buck's extension	7 wks	7 wks	2 days	0	Walled lump	Complete recovery
72	M. H.	5 yrs	M	11-27-11	Upper $\frac{1}{2}$ of shaft of left femur	0	Buck's extension	11 wks	11 wks	2 days	0	Good No shortening	Complete recovery
73	J. L.	6 yrs	M	11-30-12	Lower $\frac{1}{2}$ of shaft of right femur	0	Buck's extension	13 wks	13 wks	0	0	Slight lump No shortening	Complete recovery
74	I. R.	6 yrs	M	6-8-13	Oblique fracture in middle $\frac{1}{3}$ left femur	$\frac{1}{2}$ in	Buck's extension and cast	6 wks	6 wks	2 days	2 wks	Crutches $\frac{1}{2}$ in shortening	Complete recovery
75	J. L.	6 yrs	F	5-21-06	Middle $\frac{1}{3}$	0	Buck's extension	5 5 wks	5 5 wks	0	0	Walled with slight lump	Complete recovery
76	W. S.	21 yrs	M	12-13-13	Shaft right femur overlapping upper $\frac{1}{3}$	0	Open operation plates	12 wks	12 wks	0	10 days	Considerable lump No shortening Incision looks well	Complete recovery
77	J. M.	11 yrs	M	8-17-06	Upper $\frac{1}{2}$ of shaft of right femur	2 in ununited	Cast Operated 3 times Fragments wired	12 wks	1 yr	1 wk	3 mos	Ununited	$\frac{1}{2}$ in shortening knee stiff leg crooked no pain
78	J. H.	12 yrs	M	10-23-11	Just below middle of left femur	$\frac{1}{2}$ in	Buck's extension open and plates	6 mos	6 mos	1 mo	0	Walls with lump	$\frac{1}{2}$ in shortening, slight lump no pain runs well
79	H. R.	12 yrs	M	8-30-10	Middle of femur	$\frac{1}{2}$ in	Buck's extension	6 wks	6 wks	1 day	1 mo	10 days	$\frac{1}{2}$ in shortening stiffness in knee, no pain

THAT I END RESULTS IN SINGLE FRACTURE OF FEMORAL SHAFT--Continued

No.	Name	Age	Sex	Date of capture	Location	Primary lesion	Treat- ment	Time of treat- ment	Feed	Class	Length	Condition at discharge	Present condition
40	J. D.	17	M	9-11-11	Upper 1/3 of shaft of right femur	Buck's extension	0	8 wks	1 day	0	0	No shortening, no loss of bone, no pain	1/3 in shortening, good recovery
41	J. S.	4 yrs	M	5-10-07	Middle 1/3 femur	Buck's extension	1/2 in	6 wks	5 days	2 wks	0	Crutches, no shortening	1/3 in shortening, moderate complete recovery
42	J. H.	10 yrs	M	1-07	Lower	Buck's extension	1/4 in	6 wks	5 days	1 mo	3 wks	Crutches, 1/2 in shortening	1/3 in shortening, moderate complete recovery
43	J. P.	8 yrs	M	5-1-10	Middle 1/3 right shaft	Buck's extension	1/4 in	6 wks	0	0	0	No shortening, no lame-ness	1/3 in shortening, moderate complete recovery
44	J. R.	10 yrs	M	11-11-11	Upper 1/3 of shaft of left femur	Buck's extension	0	6 wks	1 wk	0	0	No shortening, slight loss of bone in knee	1/3 in shortening, moderate complete recovery
45	J. G.	6 yrs	M	6-11-11	Middle of right femur	Plaster cast	0	6 wks	0	0	0	No cast, 1/2 in shortening	1/3 in shortening, moderate complete recovery
46	H. D.	5 yrs	F	10-10-10	Middle 1/3 of left femur	Buck's extension	0	8 wks	0	0	0	Healed for both legs to over 1/2 in angulation	1/3 in shortening, no complete recovery
47	A. M. E.	10 yrs	F	1-15-11	Middle 1/3	Buck's extension and plaster cast	1/2 in	7 wks	2 days	0	0	1/2 in shortening, knee very stiff	1/3 in shortening, no complete recovery
48	J. J.	15 yrs	M	11-15-11	Middle of shaft of right femur	Buck's extension	0	17 wks	2 days	5 wks	0	1/2 in shortening, no loss of bone	Complete recovery
49	J. J.	17 yrs	M	10-24-07	Upper 1/3 of right femur	Buck's extension	1/2 in	12 wks	1 wk	3 wks	0	Crutches, 1/2 in shortening	Complete recovery
50	L. L.	13 yrs	M	7-18-07	Middle	Buck's extension	0	8 wks	0	0	0	No shortening, still firm in knee	Complete recovery
51	J. P.	13 yrs	F	5-18-05	Lower 1/3 of right shaft	Buck's extension	0	9 wks	1 day	1 mo	0	Crutches, no shortening	Complete recovery
52	J. G.	10 yrs	M	7-06	Middle of femur	Buck's extension	0	7 wks	4 days	2 wks	2 wks	Crutches, no shortening	Complete recovery
53	R. R.	1 yrs	F	11-15-11	Middle of shaft	Buck's extension	0	5 wks	2 days	0	0	No crutches, no shortening, weakness	Complete recovery
54	M. R.	13 yrs	F	11-18-09	Lower 1/3 of shaft of right femur	Buck's extension	1/2 in	8 wks	7 days	2 mo	0	Crutches, stiffness in knee, 1/2 in shortening	1/2 in shortening, no loss of bone
55	J. W.	10 yrs	M	12-1-10	Middle 1/3	Buck's extension	1/2 in	15 wks	1 wk	2 mo	0	Crutches, 1/2 in shortening	1/2 in shortening, no loss of bone
56	J. F.	11 yrs	M	10-20-09	Middle of shaft	Buck's extension	1/2 in	7 wks	3 days	0 wks	2 mo	Crutches, 1/2 in shortening	1/2 in shortening, no loss of bone
57	M. C.	13 yrs	M	4-17-11	Supercondylar	Buck's extension	1/2 in	7 wks	7 wks	3 mo	3 mo	Crutch, no 1/2 in shortening	1/2 in shortening, no loss of bone
58	J. W.	10 yrs	M	5-08	Shaft of femur, superior 1/3	Buck's extension	1/2 in	10 wks	10 wks	1 mo	3 mo	Crutches, no shortening, stiffness in knee	1/2 in shortening, no loss of bone

90	B L	24 yrs	F	12-27-10	Middle	2 1/2 in	Back's extension	6 mos	2 wks	ever	5 mo	1 1/2 in shortening stiffness in knee	1 1/2 in shortening	
100	A F	21 yrs	F	3-18-12	Lower 1/3	1/2 in	Back's extension	7 wks	2 wks	3 mos	2 mos	Crutches 1/2 in shortening stiffness in knee	1/2 in shortening no limitation of motion	
101	J G B	19 yrs	M	5-20-12	Middle of right femur	2 in	Back's extension	11 wks	11 wks	2 mos	1 mo	Crutches 1/2 in shortening stiffness in knee	1/2 in shortening no limitation of motion	
102	F C	18 yrs	M	9-8-05	Upper 1/3 of shaft of femur	2 1/2 in	Back's extension	7 wks	7 wks	5 days	2 mos	1 mo	Crutches 1/2 in shortening stiffness in knee	1/2 in shortening otherwise complete recovery
103	J B	13 yrs	M	10-10-05	Middle of shaft	2 1/2 in	Back's extension	9 wks	9 wks	2 days	2 mos	2 wks	Crutches 1/2 in shortening stiffness in knee	1/2 in shortening otherwise complete recovery
104	J A	15 yrs	M	1-5-07	Shaft left femur	1 in	Back's extension	8 wks	8 wks	2 days	4 mos	5 wks	Crutches 1/2 in shortening stiffness in knee	Complete recovery except slight limp
105	J C	17 yrs	M	6-8-12	Lower 1/3 of shaft of right femur	1 1/2 in	Back's extension	8 wks	8 wks	2 days	6 wks	2 wks	Crutches 1/2 in shortening stiffness in knee	No pain nor limitation of motion
106	J F	10 yrs	M	11-8-11	Middle of femur	0	Back's extension	8 wks	8 wks	2 days	3 mos	1 wk	No shortening, slight stiffness in knee	Complete recovery except slight limp
107	B S	27 yrs	M	8-11-06	Middle of shaft	0	Back's extension	7 1/2 wks	7 1/2 wks	3 day	2 mos	2 mos	No shortening, slight stiffness in knee	Complete recovery except slight limp
108	S M	30 yrs	F	3-27-11	Lower 1/3 of femur	0	Back's extension	6 wks	6 wks	1 wk	2 mos	4 wks	After return home went to bed slight stiffness in knee	Complete recovery
109	L D	30 yrs	M	7-10-02	Supracondylar	0	Back's extension	8 wks	8 wks	1 wk	2 mos	1 mo	No shortening, slight stiffness in knee	Complete recovery
110	W S	39 yrs	M	7-15-06	Upper and middle 1/3 of shaft of right femur	0	Back's extension	6 wks	6 wks	2 wks	3 mos	1 mo	Crutches, no shortening stiffness in knee	Complete recovery
111	W H	36 yrs	M	10-11-12	Shaft of right femur supracondylar	0	Back's extension	7 wks	7 wks	1 wk	5 wks	4 wks	Crutches stiffness in knee	Complete recovery except slight limp
112	P Q	34 yrs	M	11-27-13	Soldier's fracture	1/2 in	Back's extension	16 wks	16 wks	1 wk	0	6 mos	Went back to bed 2 mos shortening stiffness in knee	1/2 in shortening very slight limp
113	A P	26 yrs	M	7-22-13	Middle	1/2 in	Back's extension	7 wks	7 wks	1 wk	1 mo	1 mo	1/2 in shortening, stiffness in knee	1/2 in shortening no pain no stiffness
114	M L	38 yrs	M	5-10-08	Lower 1/3 right femur	2 1/2 in	Back's extension	7 wks	8 wks	1 wk	3 mos	1 mo	Crutches 1/2 in shortening, stiffness in knee	2 1/2 in shortening brace limp no pain
115	W S	32 yrs	M	2-27-14	Upper 1/3 of left femur	1/2 in	Back's extension	6 wks	6 wks	2 days	Ever since	0	Stiffness in knee 1/4 in shortening	No stiffness 1/4 in shortening
116	J A	38 yrs	M	2-20-13	Lower 1/3 right femur	1 1/2 in	Back's extension	8 wks	8 wks	5 days	6 mos	4 mos	Crutches 1/2 in shortening stiffness in knee	1/2 in shortening 1 in in 1 mo weather
117	W H	30 yrs	M	6-11-07	Upper 1/3 of femoral shaft	1/2 in	Back's extension	7 wks	7 wks	1 wk	4 mos	2 mos	Crutches 1/2 in shortening stiffness in knee	1/2 in shortening no limitation of motion, no limp
118	J R C	30 yrs	M	10-2-14	Middle of femur	1/2 in	Back's extension	14 wks	14 wks	1 wk	3 mo	3 mos	Crutches 1/2 in shortening stiffness in knee	No limitation of motion
119	M L	26 yrs	M	4-8-11	Middle of shaft of right femur	1 1/2 in	Back's extension	5 wks	5 wks	2 day	2 mos	1 mo	1/2 in shortening stiffness in knee	1/2 in shortening, no limitation of motion no limp
120	N S	17 yrs	F	2-18-07	Supracondylar fracture involving joint	2 1/2 in	Back's extension	7 wks	7 wks	2 wk	3 mos	2 mos	1 1/2 in shortening stiffness in knee	1 1/2 in shortening, pain on damp days
121	J W	35 yrs	M	3-3-10	Lower 1/3 of shaft of femur	2 in	Back's extension	14 wks	14 wks	1 wk	3 mos	3 mos	Crutches 2 in shortening stiffness in knee	No limitation of motion, no shortening

CHART I. END RESULTS IN SIMPLE FRACTURE OF FEMORAL SHAFT—Continued

No.	Name	Age	Sex	Date of Injury	Location	Primary Status	Time of Union	Time of Discharge	Time of Final Union	Time of Final Union	Time of Final Union	Time of Final Union	Time of Final Union
112	J. S.	35 yrs	M	8-11-17	Middle of shaft of right femur	Broken	12 wks	17 wks	1 wk	3 mos	2 mos	1/2 in shortening slight stiffness in knee	1/2 in shortening no limitation of motion
113	F. M.	30 yrs	M	10-20-18	Lower 1/3 of shaft of right femur	Broken	12 wks	17 wks	2 days	3 mos	1 mo	1/2 in shortening slight stiffness in knee	1/2 in shortening slight stiffness in knee
114	M. A.	35 yrs	M	4-10-19	Shaft right femur supra condylar	Broken	12 wks	17 wks	1 day	4 mos	2 mos	1/2 in shortening slight stiffness in knee	1/2 in shortening slight stiffness in knee
115	R. J.	31 yrs	M	7-17-11	Left middle	Broken	12 wks	17 wks	1 wk	1 mo	0	1/2 in shortening slight stiffness in knee	1/2 in shortening slight stiffness in knee
116	J. H.	38 yrs	M	10-15-09	Lower 1/3 right femur	Broken	12 wks	17 wks	1 wk	2 mos	2 wks	1/2 in shortening slight stiffness in knee	1/2 in shortening slight stiffness in knee
117	P. M. G.	35 yrs	M	8-05-05	Irrregular transverse fracture lower 1/3 of left femur	Broken	12 wks	17 wks	1 day	6 mos	2 mos	1/2 in shortening slight stiffness in knee	1/2 in shortening slight stiffness in knee
118	F. I.	35 yrs	F	3-10-13	Middle of femoral shaft	Broken	12 wks	17 wks	2 days	6 mos	1 mo	1/2 in shortening slight stiffness in knee	1/2 in shortening slight stiffness in knee
119	R. L.	33 yrs	M	10-1-05	Middle of femur	Broken	12 wks	17 wks	1 wk	3 mos	2 mos	1/2 in shortening slight stiffness in knee	1/2 in shortening slight stiffness in knee
120	L. M.	34 yrs	M	3-10-06	Upper 1/3	Broken	12 wks	17 wks	1 wk	4 mos	1 mo	1/2 in shortening slight stiffness in knee	1/2 in shortening slight stiffness in knee
121	M. S.	30 yrs	F	11-1-10	Middle of shaft of right femur	Broken	12 wks	17 wks	8 days	3 yrs	0	1/2 in shortening slight stiffness in knee	1/2 in shortening slight stiffness in knee
122	H. K.	30 yrs	M	9-10-06	Upper 1/3 of shaft	Broken	12 wks	17 wks	1 wk	6 mos	2 mos	1/2 in shortening slight stiffness in knee	1/2 in shortening slight stiffness in knee
123	J. C.	40 yrs	M	9-13-11	Supracondylar	Broken	12 wks	17 wks	0	7 mos	2 yrs	1/2 in shortening slight stiffness in knee	1/2 in shortening slight stiffness in knee
124	A. W.	36 yrs	F	3-11-13	Lower 1/3	Broken	12 wks	17 wks	1 wk	1 yr	1 mo	1/2 in shortening slight stiffness in knee	1/2 in shortening slight stiffness in knee
125	D. M. C.	31 yrs	M	11-10-10	Middle 1/3 of shaft of left femur	Broken	12 wks	17 wks	3 wks	2 yr	Ever	1/2 in shortening slight stiffness in knee	1/2 in shortening slight stiffness in knee
126	J. M. C.	34 yrs	M	6-15-11	Middle of right femur	Broken	12 wks	17 wks	5 days	5 mos	2 mos	1/2 in shortening slight stiffness in knee	1/2 in shortening slight stiffness in knee
127	A. R.	30 yrs	F	9-9-07	Upper 1/3	Broken	12 wks	17 wks	1 wk	6 mos	1 mo	1/2 in shortening slight stiffness in knee	1/2 in shortening slight stiffness in knee

138	G D	58 yrs	M	11-4-06	Middle 1/3 of left femur	1 1/2 in	Back's extension	12 wks	12 wks	1 wk	8 mos	Ever since	Much stiffness in knee 1 1/2 in shortening	1 1/2 in shortening stiffness pain in wet weather
139	J B	57 yrs	M	3-10-10	Middle of shaft of right femur	1 1/2 in	Back's extension	7 wks	7 wks	5 d 1/2	6 mos	2 1/2 yrs	Crutches 1 1/2 in shortening stiffness in leg and knee	1 1/2 in shortening, does not use cane
140	T S	55 yrs	M	6-4-09	Middle of shaft of left femur	1 1/2 in	Back's extension	7 wks	7 wks	1 wk	5 mos	2 mo	1 1/2 in shortening, much stiffness in knee	1 1/2 in shortening no stiff ness no pain limp
141	A W	53 yrs	F	1-21-12	Left femur salter's fracture	1 1/2 in	Back's extension	8 wks	8 wks	1 d 1/2	3 wks	10 mos	Crutches 1 1/2 in shortening, stiffness in knee	1 1/2 in shortening slightly stiff pain wet weather
142	L J	50 yrs	M	1-20-11	Lower 1/3 right femur	1 in	Back's extension	7 wks	7 wks	2 1/2 yrs	3 mo	3 mos	Crutches 1 in shortening, stiffness in knee	1 in shortening, no limitation of motion limp
143	G D	53 yrs	M	11-4-06	Middle of femoral shaft	1 1/2 in	Back's extension	11 wks	11 wks	1 wk	5 mo	3 mos	Crutches 1 in shortening, stiffness in knee	1 in shortening no limitation of motion limp
144	V S	57 yrs	F	9-16-11	Upper 1/3 left femur	1 1/2 in	Back's extension	9 wks	9 wks	1 wk	0	1 yr since	1 1/2 in shortening, much stiffness in knee	1 1/2 in shortening no stiff ness some cane
145	A S	50 yrs	F	11-20-13	Upper 1/3 of shaft of left femur	1 1/2 in	Back's extension	7 wks	7 wks	1 wk	1 yr	Since	Went home on ambulance 1 1/2 in shortening stiff	1 1/2 in shortening pain in wet weather
146	A J	54 yrs	F	4-30-08	Middle of shaft of femur	1 1/2 in	Back's extension	8 wks	8 wks	1 wk	6 mos	2 mos	Crutches 1 1/2 in shortening stiffness in knee	1 1/2 in shortening wears high heel stiffness
147	A L	60 yrs	F	2-15-11	Middle of left femur	2 in	Back's extension	12 wks	12 wks	1 wk	1 yr since	1 yr	Crutches 2 in shortening, stiffness in knee	2 in shortening stiffness pain wet weather
148	W V	60 yrs	M	5-10-08	Upper 1/3 of left shaft	2 in	Back's extension	6 wks	6 wks	4 d 1/2	6 mos	1 mo	1 1/2 in shortening stiffness in knee	1 1/2 in shortening limp, no pain
149	W K	50 yrs	M	7-7-12	Lower 1/3 of shaft of femur	1 1/2 in	Back's extension	5 wks	5 wks	1 wk	4 5 mos	4 mos	1 1/2 in shortening stiffness in knee	1 1/2 in shortening no limitation of motion
150	M W	66 yrs	F	5-2-07	Lower 1/3 right femur	1 1/2 in	Back's extension	5 wks	5 wks	2 d 1/2	6 mos	1 mo	1 1/2 in shortening, stiffness in knee	1 1/2 in shortening slight limp
151	G R R	50 yrs	M	7-7-10	Middle of femur	1 1/2 in	Back's extension	7 wks	7 wks	4 d 1/2	3 mos	4 mos	1 1/2 in shortening, stiffness in knee	1 1/2 in shortening pain in wet weather
152	S K	52 yrs	M	10-27-13	Middle of shaft of left femur	1 in	Back's extension	7 wks	7 wks	4 d 1/2	4 mos	2 mos	Crutches 1 in shortening	1 in shortening pain in wet weather
153	J B	40 yrs	F	12-21-13	Middle of femur	1 1/2 in	Back's extension	6 wks	6 wks	2 d 1/2	Ever since	0	Crutches, 1 in shortening stiffness in knee	1 in shortening crutches no stiffness
154	J M C L	55 yrs	M	2-9-10	Middle of left femur	1 1/2 in	Back's extension	11 wks	11 wks	1 wk	4 5 mos	2 mos	1 1/2 in shortening, stiffness in knee	1 1/2 in shortening no limitation of motion
155	A M	56 yrs	F	4-5-13	Right supracondylar	1 1/2 in	Back's extension	9 wks	9 wks	1 wk	2 mos	3 mos	Crutches 1 1/2 in shortening, stiffness in knee	1 1/2 in shortening
156	W M	53 yrs	M	8-2-09	Lower 1/3 left femur	1 1/2 in	Back's extension	13 wks	13 wks	1 wk	1 yr since	0	1 1/2 in shortening stiffness in knee	1 1/2 in shortening crutches
157	A C	50 yrs	F	6-14-13	Just below greater trochanter lower fragment pulled in left previous injury	1 1/2 in	Back's extension	4 wks	4 wks	1 wk	4 mos	6 wks	1 1/2 in shortening, much stiff ness in knee	Limp due to previous injury
158	W M	49 yrs	M	12-4-04	Middle and lower 1/3 of right femur	1 1/2 in	Back's extension	7 wks	7 wks	1 wk	5 mos	3 mos	1 1/2 in shortening, much stiff ness in knee	1 1/2 in shortening, no limitation of motion

CHART I. END-RESULTS IN SIMPLE FRACTURE OF FEMORAL SHAFT—Continued

No.	Name	Age	Sex	Date of fracture	Location	Primary displacement	Treatment	Hours of fixation	Bed	Chair	Crutches	Care	Cause of discharge	Present condition
159	W. M. S.	41 yrs	M	5-9-12	Ununited fracture of lower 1/3 of right femur	1 1/2 in fracture displaced in flexion	1 in ununited fracture displaced in flexion	0	3 wks	10 wks	0 mos	0 mos	Crutches stiffness in knee	Heal on levels of no injury 3 wks
160	L. P.	43 yrs	F	5-1-12	Middle of right femur	1 in Buck's extension	1 in Buck's extension	7 wks	2 wks	2 wks	1 yr	2 yrs	Crutches stiffness in knee	1 1/2 in shortening at knee pain damp weather
161	L. W.	43 yrs	M	7-10-12	Middle of right femur	1 in Buck's extension	1 in Buck's extension	6 wks	6 wks	1 day	1 mo	1 mo	1 in shortening 2 in shortening of motion stiffness in knee	1 in shortening stiffness in knee damp weather
162	W. H. D.	43 yrs	M	2-1-12	Lower 1/3 of right femur	1 in Buck's extension	1 in Buck's extension	11 wks	11 wks	1 wk	2 mos	2 mos	Crutches 2 in shortening stiffness in knee	1 in shortening pain on climb stairs
163	W. W.	43 yrs	M	9-8-12	Middle and upper 1/3 of right femur	1 1/2 in Buck's extension	1 1/2 in Buck's extension	10 wks	10 wks	1 day	6 mos	2 yrs	Crutches 1 1/2 in shortening 1 1/2 in shortening of motion (knee)	1 1/2 in shortening fairly good motion
164	M. H. H.	44 yrs	F	10-10-12	Middle of shaft of left femur	2 in Buck's extension	2 in Buck's extension	3 wks	3 wks	2 days	1 mo	1 mo	Crutches 2 in shortening 2 in shortening of motion (knee)	2 in shortening 2 in shortening of motion (knee)
165	H. Q.	44 yrs	M	8-20-12	Middle of right femur	2 in Buck's extension and cast	2 in Buck's extension and cast	12 wks	12 wks	6 mos	7 mos	1 yr	Crutches 2 in shortening 2 in shortening of motion (knee)	2 in shortening 2 in shortening of motion (knee)
166	L. P.	40 yrs	M	11-1-12	Upper 1/3 of shaft of femur	1 1/2 in Buck's extension	1 1/2 in Buck's extension	7 wks	7 wks	1 wk	4 mos	2 mos	Crutches, stiffness in knee	1 1/2 in shortening 1 1/2 in shortening of knee
167	H. M. C.	40 yrs	M	1-10-12	Upper 1/3 of shaft of femur	1 1/2 in Buck's extension	1 1/2 in Buck's extension	7 wks	7 wks	1 wk	4 mos	1 mo	Crutches, stiffness in knee	1 1/2 in shortening 1 1/2 in shortening of knee
168	J. K.	41 yrs	M	1-18-12	Lower 1/3 of left femur	1 1/2 in Buck's extension	1 1/2 in Buck's extension	12 wks	12 wks	1 wk	8 mos	2 mos	Crutches 2 1/2 in shortening 2 1/2 in shortening of knee	2 1/2 in shortening 2 1/2 in shortening of knee
169	J. L.	43 yrs	M	11-8-12	Middle and lower 1/3 of right femur	1 in Buck's extension	1 in Buck's extension	7 wks	7 wks	1 wk	3 mos	3 wks	Crutches 1 in shortening 1 in shortening of knee	1 in shortening 1 in shortening of knee
170	V. L.	41 yrs	M	6-5-12	Middle	1 in Buck's extension	1 in Buck's extension	7 wks	7 wks	1 wk	3 mos	2 mos	Crutches 1 1/2 in shortening 1 1/2 in shortening of knee	1 1/2 in shortening 1 1/2 in shortening of knee
171	J. M.	41 yrs	M	11-22-12	Lower 1/3 of femur	1 in Buck's extension	1 in Buck's extension	8 wks	8 wks	5 days	3 mos	6 mos	Crutches 1 1/2 in shortening 1 1/2 in shortening of knee	1 1/2 in shortening 1 1/2 in shortening of knee
172	W. M.	40 yrs	M	1-10-12	Lower 1/3 of left femur	1 in Buck's extension	1 in Buck's extension	12 wks	12 wks	2 wks	2 mos	4 mos	Crutches 1 in shortening 1 in shortening of knee	1 in shortening 1 in shortening of knee
173	T. B.	43 yrs	M	8-9-12	Middle of shaft of femur	1 in Buck's extension	1 in Buck's extension	8 wks	8 wks	1 wk	6 mos	1 yr	Crutches 1 in shortening 1 in shortening of knee	1 in shortening 1 in shortening of knee
174	S. K.	43 yrs	M	3-12-12	Middle of shaft of right femur	1 in Buck's extension	1 in Buck's extension	7 wks	7 wks	3 days	2 mos	1 mo	Crutches 1 in shortening 1 in shortening of knee	1 in shortening 1 in shortening of knee
175	W. B.	43 yrs	M	9-12-12	Middle of shaft of femur	1 in Buck's extension	1 in Buck's extension	8 wks	8 wks	1 wk	2 mos	2 mos	Crutches 1 in shortening 1 in shortening of knee	1 in shortening 1 in shortening of knee
176	L. K.	43 yrs	F	3-12-12	Upper 1/3 of femur	1 in Buck's extension	1 in Buck's extension	10 wks	10 wks	1 yr	1 mo	0	Two and taken home as a shoulder	Two and taken home as a shoulder

No	Name	Age	Sex	Date of Fracture	Location	Treatment	Death
120	M. B.	5 years	F	8-1-10	Middle of right femur	Buck's extension	Died in 3 hours from shock
121	J. C.	5 years	M	3-7-11	Middle of left femur	Buck's extension overhead	Died in 3 months from acute gastro-enteritis
122	P. McC.	5 years	M	7-15-11	Middle of right femur	Buck's extension	Died in 43 weeks from tuberculous
123	K. R.	33 years	F	9-7-07	Middle of left shaft	Buck's extension	Died in 3 weeks from pneumonia
124	S. N.	24 years	M	9-5-13	Upper 1/3 of left femur	Buck's extension	Died in 23 days from lobar pneumonia
125	J. McM.	22 years	M	11-3-10	Upper 1/3, right femur	Buck's extension	Died in 5 days from delirium tremens
126	G. W.	29 years	M	6-3-09	Middle of left femur	In bed Sand bags	Died in 2 hours from shock
127	H. M.	25 years	M	8-10-11	Middle of left femur	Buck's extension	Died in 12 weeks from late ad infarction and shock
128	J. G.	47 years	M	7-5-12	Middle of left femur	Buck's extension	Died in 6 hours from shock
129	C. L.	48 years	M	7-1-04	Left femur subtrochanteric	Buck's extension	Died in 23 hours from shock
130	L. C.	54 years	M	5-11-09	Upper 1/3 left femur	Buck's extension	Died in 4 days from delirium tremens
131	P. C.	52 years	M	5-10-06	Upper 1/3 right femur	Buck's extension	Died in 9 days from delirium tremens
132	M. F.	40 years	M	11-5-07	Right femoral shaft, supracondylar	Buck's extension	Died in 8 weeks from delirium tremens
133	J. T.	56 years	M	4-12-11	Middle of left femur	Buck's extension	Died in 3 weeks from delirium tremens
134	H. McV.	57 years	F	9-20-07	Lower 1/3 right femur	Buck's extension	Died in 1 week from broncho-pneumonia
135	J. B.	55 years	M	11-10-13	Upper 1/3 right femur	Buck's extension	Died in 3 weeks from pneumonia
136	P. L.	59 years	F	8-15-13	Middle of left femur	Buck's extension	Died in 3 weeks from pneumonia
137	J. H.	48 years	M	7-12-10	Middle of left femur	Buck's extension	Died in 3 weeks from delirium tremens
138	M. M.	63 years	F	2-20-15	Middle of left femur	Buck's extension	Died from shock
139	P. R.	63 years	M	1-18-09	Middle of left femur	Buck's extension	Died in 4 weeks from pneumonia
140	W. W.	68 years	F	3-7-11	Upper left femur	Buck's extension	Died in 6 weeks from pneumonia
141	H. A.	61 years	M	4-11-07	Middle of right femur	Buck's extension	Died in 8 weeks from pneumonia
142	M. B.	68 years	F	7-5-07	Left femur subtrochanteric	Buck's extension	Died in 2 months from broncho-pneumonia
143	C. S.	60 years	M	1-10-09	Middle of left femur	Buck's extension	Died in 3 months from lobar pneumonia
144	A. P.	60 years	M	7-13-10	Middle both femoral shafts	Buck's extension	Died in 15 hours from shock
145	H. W.	82 years	F	5-2-06	Middle of left femur	In bed Sand bags	Died in 2 hours from shock
146	A. R.	65 years	M	11-10-15	Middle	Buck's extension	Died in 5 days from pulmonary edema and asphyxia
147	J. V.	80 years	M	1-27-11	Supracondylar	Buck's extension	Died in 5 weeks from Bright's disease
148	A. McA.	78 years	M	7-10-06	Middle of right femur	Buck's extension	Died in 8 weeks from uremia and sepsis of lungs
149	M. S.	84 years	F	11-11-10	Subtrochanteric	Buck's extension	Died in 5 days from acute cardiac dilatation
150	N. R.	70 years	F	6-6-13	Bilateral fracture of both femoral shafts (middle)	Buck's extension	Died in 2 months from acute respiratory
151	J. N.	80 years	M	5-10-00	Upper 1/3	Buck's extension	Died in 2 weeks from gangrene
152	W. R.	98 years	M	7-3-15	Subtrochanteric	Buck's extension	Died in 2 weeks from renal ty
153	H. J.	80 years	M	10-6-13	Middle	Buck's extension	Died in 2 months from senile p
154	A. J.	75 years	M	4-8-09	Upper 1/3 left femur	Buck's extension	Died in 2 weeks from septicemia
155	M. L.	82 years	M	6-1-04	Middle of left femoral shaft	Buck's extension	Died in 6 days from pneumonia
156	W. H.	70 years	M	7-17-06	Supracondylar right femur	Buck's extension	Died in 3 weeks from pneumonia
157	M. N.	71 years	F	2-5-11	Lower 1/3	Buck's extension	Died in 2 months from broncho-pneumonia
158	J. K.	70 years	M	1-15-12	Middle	Buck's extension	Died in 1 week from pneumonia
159	A. G.	70 years	F	4-10-11	Middle	Buck's extension	Died in 1 week from pyelitis pneumonia
160	V. W.	72 years	F	3-10-13	Upper 1/3 left femur	Buck's extension	Died in 1 week from pneumonia
161	M.	80 years	F	9-15-09	Upper 1/3 right femur	Buck's extension	Died in 1 week from broncho-pneumonia
162	H. O. N.	70 years	M	11-1-08	Middle of right femur	Buck's extension	Died in 2 months from pneumonia
163	S. W.	80 years	M	1-1-10	Middle of left femur	Buck's extension	Died in 2 weeks from pneumonia

leading hospitals of Philadelphia this fact has been recognized and during the past six months for the word "cured" on their discharge blank has been substituted a report of the exact condition as regards the deformity and function of the affected limb

In the hope of determining with some degree of accuracy the ultimate prognosis of simple fracture of the femoral shaft I have examined the records of these cases of seven Philadelphia hospitals: the University, Methodist, Episcopal, Jewish, Jefferson, Pennsylvania, and German, for the years 1904 to 1914. This examination comprised all cases treated in the wards of those institutions for simple fracture of the femoral shaft

The list of cases thus collected numbered 400 and an effort was then made to look up each patient at his home. Of these it was possible to obtain the end-results in 242 patients, either by visiting them in their homes, or because death occurred while the patient was in the hospital. One hundred fifty-eight patients could not be traced

The points investigated in each case were (1) the site of the fracture, (2) the method of treatment, (3) duration of extension, (4) length of stay in bed, (5) period spent in chair, (6) duration of crutch and cane, (7) condition at the time of discharge, (8) the condition at the present time, (9) the effect on earning capacity

Of the 242 cases tabulated below 96 were children under 16 years and 146 were adults

TABLE I

Age	Number of Patients	Recoveries
Under 2 years	14	12
2 to 15 years	72	62
15 to 25 years	10	7
25 to 40 years	31	6
40 to 60 years	38	5
60 to 70 years	15	0
70 to 80 years	7	1

In the group of 14, 12 completely recovered. Of the two who did not, one (Case 13) had a paralyzed leg ever since the accident and at the present time (August 1914) 1½ inches of shortening, though at the time of discharge there was no shortening. In one (Case 14) there was considerable angulation and the child has to wear a brace. Ten of the

fractures in this group were situated in the middle of the shaft, 3 in the lower third, and 1 in the upper third

In the group of 72 between the ages of 2 to 13 years, 62 completely recovered. There were 3 cases of non-union in which open operations were performed (plated and wired). One (Case 176) completely recovered. The other two have shortening and one has some limitation of motion. In 7 cases there was an average shortening of one-fourth inch, one (Case 86) of angulation required braces. In this group 40 fractures were situated in the middle of the shaft, 19 in the lower third and 13 in the upper third

In the group of 19 cases between the ages of 13 and 25 years were 7 complete recoveries and 12 cases of shortening in 1 case ¾ inch, in 3 cases ¼ inch, in 2 cases ½ inch, in 4 cases 1 inch, in 1 case 1½ inches, in 1 case 2 inches. In this group 11 fractures were situated in the middle of the shaft, 6 in the lower third and 2 in the upper third

In the group of 23 cases between the ages of 25 and 40 years there were 6 complete recoveries, 16 of shortening and 1 of non-union. The latter (Case 128) was treated by open operation and plating and at present has one inch shortening. The amount of shortening in the 16 cases is divided as follows: in 3 cases ¼ inch, in 7 cases ½ inch, in 1 case ¾ inch, in 2 cases 1 inch, in 1 case 1¼ inches, in 1 case 2 inches and in 1 case 2½ inches. In this group 11 fractures occurred in the lower third, 9 in the middle of the shaft, and 3 in the upper third

In the group of 48 cases between the ages of 40 and 60 years only 3 recovered completely, while in 45 there was shortening divided as follows: in 2 cases ¾ inch, in 4 cases ½ inch, in 6 cases ¾ inch, in 10 cases 1 inch, in 1 case 1¼ inches, in 12 cases 1½ inches, in 2 cases 1¾ inches, in 5 cases 2 inches, in 1 case 2¼ inches, in 1 case 2½ inches, and in 3 cases 3½ inches. In one (Case 157) measurements were not recorded because there had been shortening from a previous injury. In one (Case 159) there was non union treated finally by open operation and plating. In two (Cases 135 and 165) a chronic ulcer remained on the tip of the heel of the fractured leg. In this

VAGINAL SUPRAVAGINAL HYSTERECTOMY FOR PROCIDENTIA AND LARGE CYSTORECTOCELE ASSOCIATED WITH CHRONIC FIBROSIS UTERI¹

By IRAM N. VINEBERG, M.D., F.A.C.S., NEW YORK

IT is fairly well established that vesico vaginal interposition fulfills the object in view in most cases of procidentia and large cystorectocele when the climacteric is near at hand, or when the woman has already borne a good-sized family and further pregnancy may be eliminated. But the operation calls for a fairly normal uterus, in other words, if the uterus is very large through the existence of fibroid nodules or diffuse fibrosis, or is exceedingly small, through senile atrophy, it is contra indicated. The same applies to those cases not so uncommon, in which the uterus, though of normal average size, is the subject of uncontrollable bleeding. The latter is usually observed in women approaching the menopause.

The method of procedure in chronic fibrosis associated with procidentia or cystorectocele has consisted either in a total hysterectomy, with the customary plastic upon the vaginal walls, or in the excision of a wedge-shape portion from the body and fundus. The first, that of total hysterectomy, possesses the objection that it leaves no solid tissue which can act as a support to the bladder. Whether this deficiency can be met by the technique of Goffe and Mayo whereby the round ligaments and the broad ligaments are sutured together, I am unable to say from personal experience. This much may be said—that the technique in either case demands the greatest skill and the most extensive experience, and should, in any case, be limited, as C. H. Mayo² correctly states, to cases of the third and fourth degrees of prolapse with atrophy of the uterus and distention of the vaginal outlet in which there is not enough solid tissue available for any type of an interposition operation.

The second method, that of excision of a wedge from the body and fundus, with which I have had considerable experience, fulfills

the purpose in some cases and has the advantage in not creating the artificial menopause. But it has its drawbacks in that the uterus in many cases is too bulky and its walls are too thick and fibrous to lend itself to the procedure. Furthermore, in all instances it leaves a long line of suture in none too normal tissue, that does not always heal kindly and may be attended with profuse and prolonged suppuration. Still further, there may be very considerable oozing from the line of suture giving rise to a troublesome hematoma between the uterus and vaginal wall, if proper provision be not taken against it. In one case reported by Lowit, the bleeding was so great as to necessitate a subsequent hysterectomy.

A third vaginal method, which I have been practicing for over three years and to which I wish to draw attention, consists in amputating the body of the uterus fairly high up and utilizing the cervical stump as a *pelote* to hold up the bladder. When the woman is still comparatively young and the creation of the artificial menopause may be undesirable, the amputation may be done so high up as to leave together with the adnexa the lower segment of the uterus, with a corresponding area of endometrium. But not infrequently, a difficulty presents itself in that the vaginal portion is very much hypertrophied and elongated or badly lacerated with considerable eversion of the cervical mucosa. Where these conditions have presented themselves, I have amputated the lower portion of the cervix, leaving only a comparatively short cervical stump, extending from the vaginal vault to the lower uterine segment, and utilizing this for my purpose to support the bladder. After the redundant vaginal flaps are resected to the extent that the individual case demands, the cervical stump is sutured to the subpubic fascia and to the anterior vaginal wall. The bladder is

¹ Surg. Gynec. & Obst. 1915, xx, 253.

² Read before the Obstetric Section of the New York Academy of Medicine, February 13, 1915.

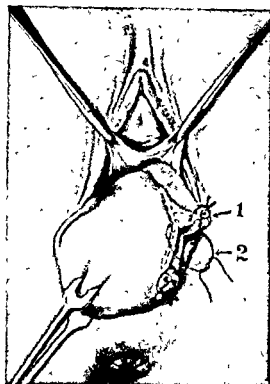


Fig. 1. (1) Left adnexa ligated and severed. (2) Ligature thrown around the uterine artery. Knotted, but not tied.

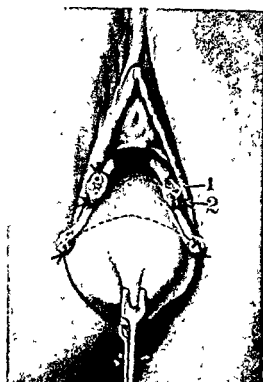


Fig. 2. Dotted line indicating the level of the amputation.

then forced to take a position within the abdomen and its prolapse is prevented by the firmly fixed cervical stump. The operation is completed by doing the necessary operation upon the posterior vaginal wall and perineum.

Lowit¹ as far as I can ascertain, was the first to employ the cervical stump after doing a vaginal amputation of the uterus as a *prole* to hold up the bladder in cases of procidentia and cystocele. My technique differs from that of Lowit in the application of the subpubic suture (vide Fig. 3). This is passed underneath the mucosa and through the subpubic fascia and has the effect of bringing the top of the cervical stump well up against the pubic arch. I deem this feature of great value. Another point of difference consists in excising most of the lower vaginal portion which may be either very much

hypertrophied and lacerated, or so elongated as to interfere with the results of the operation if left as it is.

The steps of the operation are as follows: (1) Longitudinal incision of the anterior vaginal wall, extending from near the urethral meatus to within an inch or an inch and a half of the cervical os. (2) Separation by sharp or blunt dissection of the vaginal walls from the underlying bladder. (3) The bladder is pushed up from the uterus and the base of the broad ligaments by gauze or scissor dissection. (4) Transverse incision of the vesico-uterine peritoneal fold. (5) Delivery of the body of the uterus through the vaginal incision. Up to this, the steps are identical with those followed in vesico-uterine interposition. (6) If the ovaries are to be preserved, a ligature is passed around the ovarian ligaments and the uterine end of the tube, on either side, and tissues cut

¹Zentralblatt für Gynäk. 1911, xxx, 29.

between the ligature and the uterus (Fig. 1). If the ovaries are to be removed, the ligature is passed around the infundibule pelvic ligament, containing the ovarian vessels (7) A ligature is passed at the level of the os internum, to embrace the uterine artery on either side, Fig. 2 The body of the uterus is then amputated at the desired level by a wedge shaped incision, the thin edges of the wedge pointing toward the cervix The edges of the wound in the cervix are then brought together by a continuous or interrupted catgut suture, and the raw area of the cervix laterally is sutured in the same way (8) Suturing of the cervical stump to the subpubic fascia and anterior vaginal wall as above described, Fig. 3

Thus far I have had occasion to perform the operation ten times, the first operation being done over three years ago Two of the operations were done during the past two months, and hence must be excluded for the present, regarding end-results Of the other eight cases one was under observation for three years and three months, two for fifteen months, three, for twelve months, one, for eight months, and one was lost sight of after she left the hospital The results in all the observed cases were excellent from an anatomic standpoint, and were good from a clinical standpoint, excepting in one This patient continued complaining of an uncomfortable bearing-down feeling and from frequency of micturition, although there was no recurrence of the cystocele, but the vaginal portion of the cervix, which was very long, came down to the introitus In this instance I should have done a partial amputation of the vaginal portion, as I had done in all of the other cases that presented long and hypertrophied cervixes

The value of the procedure was particularly well illustrated in the following case

The patient, 23 years of age had had an abdominal supravaginal hysterectomy done in an out of town hospital sixteen months before she was admitted to the Second Gynecologic Service of Mt Sinai Hospital on August 19, 1914 A couple of months afterward the patient noticed that everything came down as before the operation At the time of her admission the long cervix with bladder and rectum were protruding from the vagi-

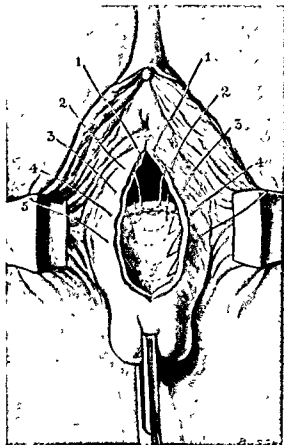


Fig. 3 Cervical stump with subfascial suture (1) and vaginal sutures (2, 3, 4 and 5) in place

na August 21, operation The anterior vaginal wall was incised from the urethral meatus to near the cervical os the bladder was dissected away from the cervix and the base of the broad ligaments On opening the peritoneal cavity a long fibrous band was found stretching from the cervical stump to the abdominal wall This was severed The redundant vaginal flaps were then excised, and after the cervical stump was shortened by a liberal excision of its lower part it was sutured to the subpubic fascia and to the vaginal wall, as described above The operation was completed by a suitable posterior colporrhaphy I examined the patient yesterday, seven months after the operation, and the result is simply perfect The cervical stump is high up in the vaginal vault, both vaginal walls are in apposition, and when the patient bears down there is as little protrusion of the anterior vaginal wall as there would be in a normal nullipara The patient felt perfectly well, and she stated that the parts felt as firm as before she had ever had a child

MYOMA OF THE STOMACH

REPORT OF A CASE SUCCESSFULLY REMOVED

By J. F. JAMES, JR., M.D., F.A.C.S., and S. W. SAPPINGTON, M.D., PHILADELPHIA

THE warrant for a single case report is usually found in the rarity of the condition and this obtains in the present instance. While myoma is the third most important tumor of the stomach, it is so far behind cancer in point of incidence that, like sarcoma, the second in importance and frequency, it is a clinical and pathologic rarity.

More practical interest, however, attaches to another point. The relatively rapid increase in case reports of myomata of the stomach is an index of the vast increase in the number of abdominal operations. Without operative interference, gastric tumors and abdominal growths in general are often indiscriminately assumed to be malignant and hopeless. But further data in the matter of gastric myomata may outline a small but definite group of cases with perhaps suggestive symptomatology. These cases may be amenable to successful operative treatment, and such patients should not be allowed to dismiss operation as out of the question and progress unaided to a fatal end. Certainly the prognosis is not of the hopeless aspect of most carcinomata of the stomach.

CASE. A freely movable, external leiomyoma of the stomach weighing 670 gr. and without metastases, removed by operation. Patient in good health and had increased in weight eight months after operation.

Clinical report. Miss B., age 63, white, school teacher. Claims to have always been in good health prior to present illness. In the past few years she has had "indigestion," the most prominent symptom being flatulency with epigastric distress. One year ago there occurred a severe gastric attack, the attending physician suspecting ulcer or malignancy. At this time there was epigastric pain, nausea, and vomiting without hematemesis and quite well marked emaciation. After subsidence of the acute symptoms, there ensued a mild attack of diarrhoea with bloody stools. The patient, however, improved, gained in weight and appetite, and was able to resume school duties, though still complaining of more or less epigastric discomfort. In six months there was recurrence of the diarrhoea

with blood in the stools, associated with abdominal distention. During this attack, a firm, movable tumor was discovered in the region of the umbilicus. Six months later, October 10, 1914, there was a further slight recurrence of the diarrhoea and abdominal examination by one of us (James) revealed a distinct, firm, rounded, non-sensitive mass, freely movable upon manipulation and change of posture. Pelvic examination failed to show any definite connection between the tumor and the pelvic organs. Unfortunately, no gastric analysis or blood examination was made.

The patient was operated upon October 19, 1914. Upon opening the abdomen the freely movable tumor was found attached by an apparently long pedicle to the anterior wall of the stomach near the lesser curvature and cardiac end. The gastric vessels were markedly enlarged and distended. The apparent pedicle was a tubular or pouched prolongation of the anterior wall of the stomach due to the dragging weight of the heavy tumor. The delicate capsule at the base of the tumor was split, the large associated vessels tied off, a small pedicle 1.5 cm. in diameter and similar in structure to the tumor ligated, and the mass removed. This left a small, protruding stump, difficult of differentiation from the stomach wall. This was removed, the 2 cm. area on the wall sutured and then inverted with a fine purse string suture. The neighboring parts, the liver and glands especially, were carefully examined for evidence of metastatic growth, but none was found.

Eight months after the operation, the patient has been free of abdominal attacks, has gained considerably in weight, and states that she feels in first-class general health.

Pathologic report. The tumor was roughly the shape of a large potato somewhat flattened on two sides (Fig. 1). It weighed 670 gr. and measured 15x11x6 cm. It was enveloped by a very thin and delicate capsule. The color was grayish white with splashes of red. On section, numerous small hemorrhagic areas were observed. Areas of fatty and mucoid degeneration were also in evidence near the central portion of the growth. Some of the larger hemorrhagic foci exhibited central softening, but there was no definite cavity formation.

Microscopically, fields of interlaced bundles of long spindle cells with rod-shaped nuclei were fairly typical (Fig. 2). Areas of degeneration with hyaline change, dilated vessels and hemorrhage were numerous (Fig. 3). No coagulation necrosis was observed and nuclear figures were not found. Connective tissue was relatively scanty. Dr. Thomas S. Cullen was kind enough to examine

several sections for us and expressed the opinion that it was probably a myoma and that the chances are about five to one that it was benign. He states that no absolute diagnosis can be made for the present and suggests that the condition of the patient after a few years should be watched with interest.

References to the literature of myomata of the stomach properly begin with Steiner (1), whose admirable monograph of 146 pages in 1898 is an exhaustive analysis of the subject. Steiner cites 23 cases. Further contributions are for the most part, as Hake (2) says, simply the reporting of additional cases. Hake himself, however, in an excellent review brought the matter up to date in 1912. Recent articles in American literature are by Thompson (3), Farr and Glenn (4), and Outland and Clendening (5). Farr and Glenn give an accurate list of reported cases and were able to increase Steiner and Hake's collection of 57 cases to a total of 84. The rapid increase of this list is indicated in the most recent summary of Nasseti (6) who has collected 140 leiomyomata of the stomach. We regret we were unable to see Nasseti's original article which is evidently a thorough treatise running through several numbers of *Tumors*. Deaver and Ashhurst (7) have a good textbook article with references.

Myoma of the stomach is in several ways unsatisfactory as a subject of accurate reference. Duplication or triplication of a single case occurs through confusion as to the proper assignment. It may be at one time ascribed to the operator, again to the reporter and still occasionally again to a writer citing the case. Bland-Sutton's case for instance was really reported by Foulerton (8). The case operated on by Ehrenberg was reported by Pels and Nielsen (9) and cited by Cohn (10). Further, there is as yet no fixed standard under which the gastric myomata may be listed and the natural histologic features are in themselves confusing. Probably a number of myomata have been considered spindle cell sarcomata and vice versa sarcomata have erroneously been called myomata. Histologically, the structures of myomata in certain fields may suggest angio sarcoma, and Cullen noted in the case here with reported that arrangement in some

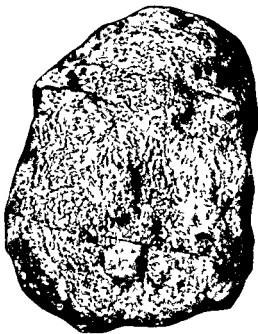


Fig 1. Photograph of tumor

areas strongly suggested a perithelial angio-sarcoma. Again the occurrence of metastases might be thought to definitely class the tumor as malignant but there is disagreement on this subject. The term malignant leiomyoma is hardly satisfactory though embryologically the connection between sarcoma and myoma is naturally close. Another source of error in collecting myomata is due to reports covering myomata of more than one part of the gastro intestinal canal or more than one variety of tumor the caption of the article misleading one looking for myomata of the stomach only. Milovanovic (11) for example in citing five cases of myoma of the esophagus reports one extending into the stomach. Nichols (12) reports a case in which a carcinoma was also present. Yates (13) reports four sarcomata and one myoma under the title of 'Sarcoma and Myoma of the Stomach'.

In spite of the increased number of case reports we have as yet no suggestive symptom complex as is apparently demonstrated by



Fig. 2. Microscopic field high power showing typical myomatous area.



Fig. 3. Microscopic field low power, showing hemorrhage and hyaline degeneration.

the fact, pointed out by Larr and Glenn that a diagnosis is yet to be made before operation or autopsy. It may be however that the rarity of the occasion for such diagnosis is the cause of failure to keep the condition in mind. The clinical division of myomata of the stomach into internal and external varieties is eminently practical. The internal myoma in location and symptomatology is almost identical with carcinoma of the stomach and is nearly always mistaken for a malignant growth. Its long duration may be a point in differential diagnosis, but often the diagnosis is made at autopsy or after operation by the microscope. The external myoma should offer better prospects for diagnosis and treatment. Freely movable, large tumors with long pedicles, even allowing the mass to reach the pelvis, should be susceptible to the fine points of differential diagnosis and particularly to successful operation. It is noteworthy that while the tumor may actually be some distance from the stomach, the dragging on that organ through the pedicle makes the symptoms predominantly and significantly gastric and epigastric. The mass is variously diagnosed as tumor or cyst of the omentum, mesentery, kidney or ovaries. The size is sometimes

remarkable, as in the 6000-gram growth reported by Perls and Neelsen. As might be suspected from the size and long pedicle of these tumors nutritive conditions are commonly faulty, and degeneration, hemorrhage, and cyst formation are frequent.

The case herewith reported presents nothing of peculiar interest. It may be said to be an average case. The object of the report is to remind diagnosticians and surgeons of the occasional occurrence of this growth.

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SPONTANEOUS RUPTURE OF THE SPLEEN¹

BY JOHN L. CANNADAY, M.D., F.A.C.S., CHARLESTON, WEST VIRGINIA

AN extended search of the literature in the Cincinnati Hospital Library, the John Crerar Library of Chicago, and the Library of the Surgeon-General's office in Washington, fails to disclose any reported cases of spontaneous rupture of the tubercular spleen, except one reported by Aufrecht (1). His case was a male 42 years of age, with an alcoholic and a tubercular history, who, while lying in bed in the hospital and talking to the orderly, complained of an unusual sensation in his left side. He requested the orderly to turn him over on that side, when he suddenly showed symptoms of severe shock and died in half an hour from the apparent onset. Post-mortem examination showed a transverse rent in the spleen 6 cm. in length. This rent involved almost the entire thickness of the spleen. From the

description given, the spleen in this case undoubtedly was the primary seat of the tuberculosis.

Berger (2), in an extensive study of spleen injuries, collected all reported cases prior to 1902. He found 132 pathological, ruptured spleens, of which 93 were malarial, 15 only enlarged, no cause stated, 5 in typhoid, 1 in typhus, 1 in pneumonia, 3 in leukaemia, 1 in hereditary syphilis, 1 in liver cirrhosis from alcoholism, 9 in pregnancy, 1 in tuberculosis, 1 in haemophilia, and 1 in varices of capsule of spleen. The tuberculosis case was Aufrecht's.

Senator and Litten (3) give as chief causes of rupture of the spleen, trauma and malaria. They mention among other causes typhus, typhoid, infarcts, pregnancy, haemophilia, and anaemia naming tuberculosis as a

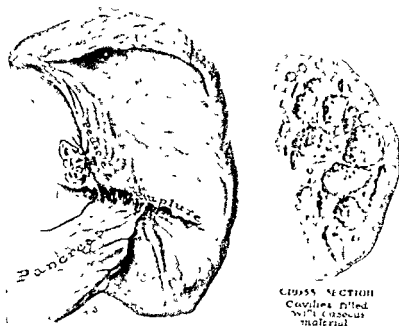


Fig. 1. Showing line of rupture of spleen. At right section of spleen showing caseous nodules.

¹Read before the Southern Surgical and Gynecological Association, Asheville, North Carolina, Decem. 27, 1914.

possible cause, but cite only Aufrecht's case. Ciaccio (4) reports 9 cases from the literature and 1 of his own, no cases of rupture. Bayer (5) reviews cases from the literature as well as his own; no case of rupture reported. Laspéyres (6) cites 5 cases of splenectomy for tuberculosis, but no case of rupture. Villard and Santy (7) report 1 case of splenectomy for massive tuberculosis of the spleen. Fischer (8) reports 1 case of operation for tuberculosis of spleen with recovery, other cases cited from the literature, no rupture mentioned. Bland-Sutton (9) reports a splenectomy for a case of primary tuberculosis spleen. Stewart (10) reports a case of primary acute splenic tuberculosis, describes 1 of his own cases, and cites 33 from literature, no case of rupture. Wintermütz (11) in his lengthy article on tuberculosis of the spleen, gives 1 case of his own, and a table of 51 cases from the literature which he says includes all the cases published except a few inaccessible ones. He does not give Aufrecht's. No cases of rupture. Death always follows if spleen is not removed. Recovery in 59 per cent of operated cases. Lorcé (12) describes 1 case of primary tuberculosis of the spleen of his own, and reviews 32 from the literature, which he says are all he could find. He does not mention rupture in any of them. Strahl (13) reports 1 case of his own and reviews the literature. No case of rupture reported. Vorwerk (14) in an extensive essay on rupture of the spleen mentions only Aufrecht's case of the rupture of the tubercular spleen. Neither Rohrbach (15) Romann (16), nor Schirra (17) in their very extensive dissertations on this subject report any cases of spontaneous rupture of the tubercular spleen. Weil (18) in his review of tuberculosis of the spleen reports no cases. Von Bruns in his new *Handbuch der praktischen Chirurgie* says rupture of the spleen is very rare in tuberculosis, but does not cite any cases. Schubert and Geipel (19) describe one case of their own and cite 33 cases from the literature. No case of rupture. Garrow (20) says "Primary tuberculosis of the spleen is rare. A few cases have been diagnosed prior to operation or autopsy. Secondary involvement is more common in children less so in adults. In

both forms the spleen is moderately enlarged; the parenchyma is soft, swollen, dark red in color, and scattered over with minute, round, gray tubercles. In the chronic form cheesy nodules, as large as hempseed or hazelnuts, may be rarely found, since death usually occurs before such changes have taken place. Splenectomy is indicated for tuberculosis of the spleen provided the diagnosis can be made and that the disease does not exist elsewhere, at least in a severe or active form." Johansson (21) in his very extensive contribution on the subject of "Spontaneous Rupture of the Spleen" was also able to find but 1 case of spontaneous rupture of the tubercular spleen, that reported by Aufrecht.

Primary tuberculosis of the spleen is uncommon, but occasional cases are seen. I found one post mortem several years ago, and I wish to present a brief report of a case which I find to be an unusual one.

March 20, 1912, a patient, M. F. M., was brought to me by Dr. W. H. Wilson of St. Albans, West Virginia. He had been to Mt. Clemens for a month, taking treatment for what he supposed to be rheumatism and while returning to his home on the train, felt a sudden severe pain in the abdomen which persisted. The patient became very weak and faint on the train, but managed to reach his home. Dr. Wilson was called and saw him four or five hours after the initial onset. He found him suffering pain and shock morphia was given to relieve the pain. The patient had a most uncomfortable night and his pulse rate gradually increased. Dr. Wilson then brought the patient to the hospital, where I first saw him, and I elicited the following history. The patient was a male 24 years old, barber by trade, had had the usual infectious diseases of childhood, was never robust, and always a little under weight. Had been feeling bad for more than a year but had continued to work at his trade most of the time. Had had occasional abdominal pains, urination had been rather frequent but he had not deemed his indisposition of sufficient importance to consult a physician until about six weeks before I saw him. At that time he was having occasional and irregular pains and tenderness in the principal joints of the long bones, along with some fever, and had diagnosed his case as one of rheumatism. He left his physician and on his own responsibility went to Mt. Clemens, where he remained for a month taking baths and other anti rheumatic treatment. The joint pains subsided and he left for his home a day's travel by train. He was lying on his back complaining of much pain on any motion, pulse 140, small volume, temperature 99° F., respiration 28 per minute, faces that of shock.

There was dullness in both flanks. A diagnosis was made of abdominal hemorrhage and immediate exploratory laparotomy advised.

He was hastily prepared for operation and under ether anesthesia, administered by Dr B S Preston, a right rectus incision about 10 cm in length was made. An abundance of free blood was present. The abdomen was explored and a search was made for the source of bleeding. On palpating the spleen, a decided rupture was felt on its median aspect. I compressed the pedicle between the thumb and the fingers of the left hand and made an incision about 17 cm in length in the left side of the abdomen over the splenic area. The spleen was easily delivered, and its pedicle was clamped preparatory to removal. In bringing up the spleen it was noticed that the tip of the tail of the pancreas was adherent near the edge of the rent. The hemorrhage had been very great and the abdomen was filled with free blood while near the spleen and extending for a short distance under its capsule was a considerable amount of dark, coagulated blood evidently the result of a previous hemorrhage, which took place under the capsule of the organ. The spleen was removed and its pedicle secured *en masse*, after which the principal vessels were each ligated separately, for further security. Aside from the spleen, the abdomen was found to be negative, with the exception of the right kidney, which was evidently completely disorganized from disease (probably tuberculosis), as it had the feel of a bag filled with fluid. Part of the free blood was sponged out and the two wounds were closed without drainage.

The spleen was about 15 cm in length, 10 cm in width and 3 cm in thickness. There were numerous tubercles on its surface. In the body of the viscus there were a number of pockets containing caseous material. In some parts of the organ there were calcareous deposits also. The caseous masses varied from 1 cm to 2.5 cm in diameter. The tear in the spleen was distinct and ragged. It was fully 7 cm in length and 1.5 cm in depth at its deepest part.

The patient made a fair operative recovery. His wounds healed primarily. The pulse gradually subsided to 120 and the temperature while fluctuating considerably, came down to nearly normal and varied from 99° F to 100° F. He left the hospital on the fourteenth day for his home. I urged on him the importance of having the right kidney removed, but he did not return to have this

done. After arriving at his home, he gradually declined and died two months afterward. No post-mortem was obtained.

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THE APPENDIX

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AND

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THE general acceptance of the views of Barclay-Smith, Metchnikoff, and Sir Arbuthnot Lane, relative to the proximal colon and appendix, is becoming more and more apparent. By these men, this entire portion of the intestinal tract is regarded as useless, and a menace to man's well-being. They hold that, by reason of our modern regimen of dietary, colonic aid is no longer "a physiological necessity" to digestion, and is, therefore, a superfluous incumbrance, thus supporting the amendatory measures of Lane.

Keith (1) suggests, that "if the great bowel is as useless and injurious as is said, then medical men are face to face with a condition which threatens the health and survival of modern civilized races." He offers here an option against such radical opinions. "In place of appealing to surgery to adapt our digestive tract to our present dietary, it seems possible we may be able to discover a diet which is suited to our present digestive tract."

It is necessary, then, in compliance with the latter and more conservative view to obtain so far as possible a correct knowledge of the nature and functions of this area. Unfortunately, as Keith remarks, we do not know, in any animal whatsoever, the exact functions of the great bowel, so far we have only guessed at them.

First it is to be noted that the contents of the ileum undergoes a marked change upon entering the cecum. Barclay-Smith (2) offered the first real tangible theory of the processes of digestion within this tract, also explanatory reasons for the existence of the so-called ileocecal valve. His theory is based on the justifiable assumption that "all the digestive changes of food within the great bowel are due, not to any digestive secretion, but to the action of bacteria which find a permanent abode in the cecum and

colon." He made the inference, which has been justified by Hertz, Case, Carmen, George, Cole, and others that "the anastaltic movements which Cannon (3) had seen, fluoroscopically, to occur in the colon of the cat, also occurred in the upper portion of the human colon and that the purpose of the ileocecal valve, so-called, was to prevent the contents of the cecum and colon, which were undergoing bacterial digestion, from being forced by anastaltic movements back into the ileum."

It is quite generally believed that a limited power of digestion is retained by this portion of the large bowel, the proximal colon; that it has the physiological function of the absorption of fluids is also admitted.

Our knowledge of the mechanical factors of this area has been much enlarged by the researches of Cannon, Elliott, Keith, and Rutherford. In 1902, Cannon (3) first described the anastaltic movements already referred to, a series of delicate, or firm undulating contractions beginning at a pulsating tonus ring usually near the mid transverse colon and extending backward toward the cecum five or six per minute and normally each series of five to fifteen or twenty minutes duration. Thus the contents of the cecum is retained for a period of time essential to completed digestion, and preparation for further disposal.

The chief factor in the induction of anastalsis is distention of the gut and within limits the greater the distention the stronger the anastaltic impulse. Gas is ever present in the intestine, save in the newborn, especially is this true of the proximal colon and it cannot be decompressed from this point in any direction except into the appendix for reasons explained later. The presence of gas is a necessary correlative of the process of digestion going on in the cecum.

Of special interest are the observations of

Cannon (4), relative to the mechanical functions of the proximal colon. "The passage of material through the ileocaecal valve seems to stimulate the colon to activity. As a mass is nearing the valve, the large intestine is usually quiet and relaxed, though occasionally indefinite movements are to be observed, and sometimes, just before the mass reaches the end of the ileum the circular fibers of the colon, in the region of the valve, contract strongly so that a deep indentation may persist for several minutes disappearing as the muscles relax just previous to the entrance of the new material. The moment the semi-fluid content enters, strong contractions take place all along the caecum and first of the ascending colon, pressing the material forward. These forces are met by deep anastaltic waves coming down from the transverse colon, sweeping back into the caecum the advancing masses of food."

The subject of the proximal colon engaged the thought of John Hunter (5), who said "If only we could understand the use of the ileocaecal valve, then we should understand the uses of the caecum." As a result of a series of observations in 1903 Keith concluded that there was always a muscular sphincter at the junction of the small intestine with the great—"it is present in the amphibian bowel, the reptilian, avian and mammalian. When the great bowel undergoes retrogression as it does in bears, in their allies, and in many forms of insectivora and edentates the ileocaecal valve is the only visible structure which remains to mark the junction of the small intestine with the large."

Keith's observations at this time concur with those of later authorities, Elliott, Barclay Smith, Sir William Macewen, and A. H. Rutherford the latter two deriving their opinions from studies on the living human subject through artificial openings of the caecum. Rutherford's (6) observations were made through "an artificial anus in the caecum 8 cm. long. This artificial anus was on the anterior wall of the caecum, roughly 3 cm. from the head of the caecum."

'Caecum. The caecum was collapsed and its interior was occupied by pink folds of mucous membrane. The interior could be

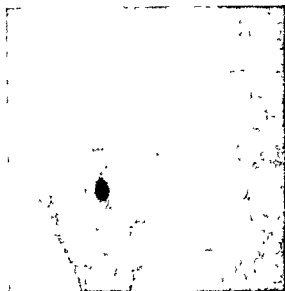


Fig. 1. On the third or fourth day following a bismuth meal it is not unusual to find a small residue in the caecum the rest of the colon having been completely emptied. This residue is often about the size of a button and represents I believe stasis about the base of the appendix. This spot of bismuth is especially likely to appear after the appendix has been removed. In such instances it seems to correspond to the portion of caecal musculature involved in the purse string invaginating suture. (As described by Dr. James T. Case, New York Medical Journal July 25, 1914.)

observed also the ileocaecal orifice when it came into view. *Colon.* The interior of the colon appeared paler than the mucous membrane of the mouth, being more of a pink color. The interior was smooth, except where the mucous membrane lay in folds. There was no appearance of sacculation in the wall of the caecum or colon. *Appendix.* At no time was the orifice of the appendix to be observed, on account of this case being an inflammatory one. *Ileocaecal valve.* As described briefly, we shall observe the ileocaecal orifice presenting a mamillary eminence of hemispherical contour, 1.8 cm. in diameter scarlet in appearance smooth and glistening the summit truncated and pierced by an orifice of a stellate appearance with lobulated elevations between the rays of the stars. "This elevation is about 0.5 to 1 cm.

¹ Under date of June 5, 1915, Dr. Case writes: "I do not think that this little shadow is held about the base of the appendix because of any sphincter action, but merely because a certain amount of caecal musculature has been put out of business by the purse-string suture. A view at variance with those of the author."



Fig. A (left) Male, dead 24 hours. Average temperature of room at time of death 50°F. B, Male, dead 24 hours. Average temperature of room at time of death 60°F. Photographic plates from *The Ileal Cecal Valve*, by A. H. Rutherford, M.D.

high." Surrounding the mammilla valve or papillary eminence of scarlet appearance is the pink colored mucous membrane of the colon and caecum, which lay in superimposed folds about the orifice. The valve mammilla was not to be observed at all times, only occasionally when peristalsis was more active within the ileum than usual or when the interior of the caecum was irrigated by warm water. "While peristalsis was moderate the orifice of the papilla would open sluggishly and the faeces would be discharged sluggishly, but while peristalsis was active the papilla would open quickly and the faeces would be ejected in jets after which the papilla would close again smartly. At times flatus would escape the papilla opening to allow its passage or fluid mixed with flatus. The sphincter action was however perfect in control and would allow nothing to pass without relaxation not even flatus. This point is of greatest interest for here as suggested by Keith Cannon and Elliott Rutherford finds the function of the ileocaecal sphincter to be that of regulating the flow of a constant semi fluid content from the small intestines and to prevent regurgitation of material back into the ileum. It was also noted by Rutherford that the exercise of this function seemed to be an automatic one the same as that of the pyloric or internal anal sphincter and without sensation in function but especially sensitive was the papilla to touch. The orifice was unyielding to attempts at dilatation there being an elastic resistance also similar to that of the internal anal sphincter. The papilla was not

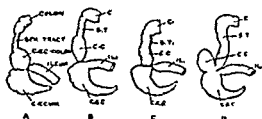


FIG. 1. "The series illustrating four functional states of the ileocaecal region of the bowel of rats. In C and D the ileocaecal sphincter is closed, in B and D it is relaxed. In C and B the sphincteric tract is closed, in C and D it is open. Various contents of the caecocolic sphincter are shown in A, B, C and D. (As described by Arthur Keith *British Medical Journal*, December 7, 1912.) Corresponding activities were observed in the appendix in Case 2.

connected by any bands, ridges, etc., to any part of the interior of the caecum, there was no appearance of frimula. *Pari passu* with the enlargement of the papilla, the orifice would open apparently by relaxation of the circular muscular fibers, and semi fluid faeces about a drachm, would be observed to emerge from the opening with a force varying with the strength of the peristalsis. Usually the discharge of faeces was obscured by reason of folds of mucous membrane. Occasionally, during active peristalsis, the papilla would emerge "shifting its position by a series of rhythmical movements of a peculiar sinuous nature as might be those of a snake whose head was fixed in cotton sheeting."

Peristalsis. "On account of the aperture forming the artificial anus in the caecum, peristalsis was probably less marked. Trauma and inflammatory conditions are well known factors in the inhibition of these forces. Psychic factors may be mentioned also.

Chloroform. Of pathological interest are the factors of chloroform action and the post-mortem changes which take place with specimens as ordinarily obtained. "Under deep anaesthesia the firm elastic mvs altered and the dimpled orifice relaxed. Instead of a mass there was now a slitlike orifice 2 1/2 cm long through which the index and middle fingers were readily passed. The circular muscular fibers could now be felt as thickened bands at the margin of this orifice."

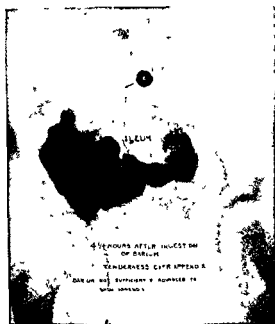


Fig 4 Four and a quarter hours after ingestion of barium

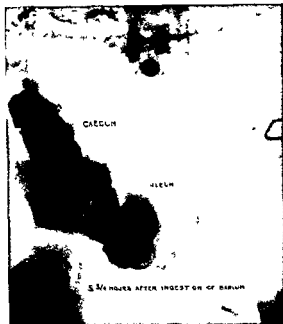


Fig 5 Five and three-quarters hours after ingestion of barium

It was found by Rutherford as previously suggested by other writers, that in order to preserve the continuity of specimen structures, it was necessary to maintain a certain low temperature of the room or surroundings in which death of the subject occurred—50 to 60° F. The specimens were then removed immediately, and the arterial system injected with formalin. It has been shown that the circular muscular fibers of the intestine undergo rapid post-mortem changes.

Briefly we have come to see that there is an elaborate neuromuscular mechanism which regulates the passage of chyme into the caecum.

"The significance of the ileocaecal orifice and sphincter is clear, if we admit they mark a point in the alimentary tract where one form of digestion ends and another begins." A form of rather complex peristalsis was observed by Rutherford, which he relates with disfluence. In the region of the caecal wall, roughly 6 cm from the papilla four small dimples appeared on observation the force causing them apparently originating in the muscular layer of the caecum. These four

dimples formed the corners of a rhomboidal figure if they were connected by lines. The first two to appear were about 4 cm apart along the circumference of the bowel, the other two about 3 cm nearer the head of the caecum, and 4 cm apart along the circumference of the bowel. Immediately these four appeared, there was a twitch, and the four corners approached as if by the contraction of a muscle connecting them, acting in the same manner as a purse-string. This immediately relaxed, and the depression of the corners disappeared . . . as probably connected with or dependent upon this type of peristalsis, it should be mentioned that while observing the interior of the caecum during that period that the valvular papilla was not visible, a pencil of firm faeces, 7.5 mm in diameter and 6 cm in length, was one day seen to be pressed out of an apparently round orifice in the wall of the caecum. This was pressed out with considerable force in a direction at right angles to the surface of the bowel, evidently molded by the circular aperture through which it emerged. After the faecal mass had been extruded, no orifice,

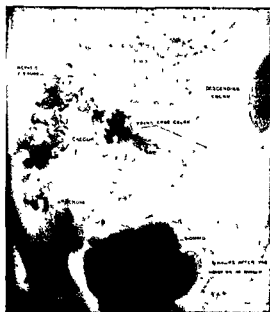


Fig 6 Six hours after ingestion of barium

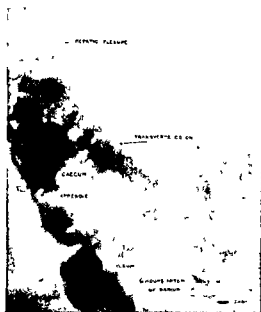


Fig 7 Six hours after ingestion of barium

however, could be discovered, and the spot from which it came had the same appearance as the rest of the intestine." The nurse in charge made frequent note of a similar occurrence. This observation suggested to Rutherford, that "below the caput cæcum coli a process of taking the semi fluid contents discharged through the ileocaecal valve into pouches seems probable. In these pouches the semi fluid contents are inspissated and then pressed out of these pouches into the lumen of the bowel, as pencil like bodies, which being pressed together, form the characteristic lobulation observed in the faeces." As to the origin of these faecal molds, I would venture the inference that, instead of being inspissated in pouches of the cæcum, which is highly improbable owing to an ever distended wall, these were molds of faeces inspissated within the lumen of the appendix and that in the instance as noted, "the extruding pencil form molds" were the product of an impaired functioning appendix, its orifice being retracted beneath the superimposing mucous membrane of the caecal wall, the same as that of the mammilla of the ileocaecal sphincter during quiescence.

Apart from the practical interest of these observations, an analogy of the functions of this and adjacent areas seem to the author apparent, thus affording a justifiable reason for an extended review. The provision for sphincteric control, the character of intestinal movements, the periodical discharge of ileal content into the cæcum, obviously are but manifestations which obtain throughout the entire intestinal tract, and suggest a similar office of appendix function.¹

The musculature of the appendix, when not inflamed, is highly tonic and contractile in its nature, its neuromusculature as complete and perfect as that of other areas of the gut, its blood and nerve supply, which is the same as that of the small intestine, is abundant, especially so at the cæco-appendiceal juncture, at which point the lumen is much narrowed, as observed in young and healthy subjects. Ochsner and Percy have recently called attention to the latter observation (*New Manual of Surgery*, p. 282).

¹ Certain well-defined locks apparently guard the progress of food through the various areas of the intestinal tract. These locks under perfect sphincteric control exercise their function through some kind of neuromuscular mechanism fully understood. It is the author's contention that at the cæco-appendiceal juncture this same sphincteric mechanism is maintained and exercises an important function in the designed factors of appendix activities.

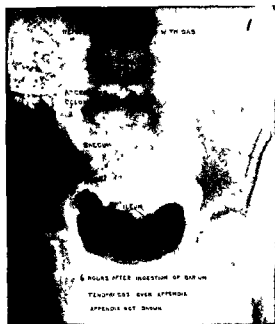


Fig 8 Six hours after ingestion of barium, tenderness over appendix which is not shown

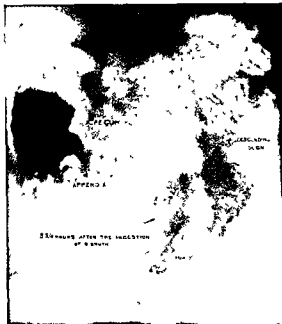


Fig 9 Five and three-quarters hours after ingestion of bismuth

A clinical observation of November 23, 1913, (7), inspired our efforts, to establish, if possible, the functional nature of the appendix. It is to be recalled that in the case referred to, the essential feature reported, was that of inflation which took place during the operation just as the caecum and appendix were being delivered in the usual manner. The subject, a child of 11 years, not being deeply anaesthetized began straining, thereby forcing gas from the distended caecum into the appendix which, in this instance, became inflated to a point near bursting.

A tonic constriction at the base of the appendix proved competent to resist any manual pressure exerted, deflation was possible only when the anaesthesia was carried to a point beyond that of abolishing muscular reflexes, as was apparent by the relaxed recti muscles, when it suddenly gave way, and the member assumed the size and contour of the normal. No bands, membranes, or kinks were present, within the lumen, however, was found a No. 6 bird shot, which according to the history given by the mother must have been an occupant of the appendix for a period of two

years, no wild game nor any other known means of conveying the shot to the child's digestive tract could be recalled by the parent, except that two years ago shot were used for the purpose of cleaning beer bottles and then thrown away. During this time, at least, the child suffered three or four quite severe attacks of gastric distress, the one previous to the operation being intense. While straining at stool the child was seized with cramps, became faint, and was carried to the bed, her condition as I found her bordering on collapse. Ochsner and Kelly (8) have for many years, recognized gas-distention of the appendix. In this instance, as with other though rare conditions, it may be presumed, that the appendix had become a retention cyst by reason of the presence of the foreign body, this being retained by sphincteric control at the base of the appendix. The sphincter during the previous faint or in the primary anaesthesia had relaxed and the cyst was emptied of its content and thus became an inflatable sack. Or by reason of the pressure exerted by exaggerated anastalsis and sphincteric forces within the caecum, induced by the



Fig. 10. Six hours after ingestion of barium

shot or irritative influence reflexly the appendix may have become distended gradually losing its normal "tone." Be that as it may, however, the point of greatest significance was the sphincteric control,¹ as described.

Cannon's work verified by Case, Carmen, and others in the human together with Keith's and Rutherford's observations form a basic foundation of physiological principles which need no further comment. Clinical observations of the past two years case histories and the examination of a large number of young children suggested during these efforts that to obtain definite evidence of the appendix musculature it would be necessary to employ roentgenological methods of observation. Also that the normal and healthy appendix might be observed it was quite imperative that our subjects be children very young persons or persons absolutely free from any abnormality of the appendix whatsoever.

This procedure became possible through

¹ Officially confirmed by Dr. A. J. Oschner recently in an appendix where the end rectum anal ring was gargantuan and in which a long fecal concretum was firmly grasped by this valve. By means of gentle manipulation the fecal concretum was forced back into the lumen of the appendix and immediately a rush of gas and fluid erupted into the caecum.

the efforts of Dr. L. G. Cole, who, for this purpose, suggested a "field day clinic," to consist entirely of such subjects, as might be supposed normal and free from abdominal disease.

Through the courtesy of Dr. E. D. Brown, New York, twenty-seven children were furnished, being loaned by their several parents for the day, March 6, 1915. This clinic took place in the Laboratory of Dr. Cole, under whom the work was carried out, and to whom we are indebted for the following report which as appended invites a most critical study.

Case 1. Age 16½ years. *Röntgenologic findings.* Cap shown distinctly. Two and one fourth hour roentgenograms show the stomach half empty, active peristalsis, cap well developed, sphincter normal, dilatation of the duodenum—possibly caused by pressure. Head of barium column in terminal portion of ileum. Six hour roentgenograms show stomach incompletely evacuated, with the head of the column of barium in the transverse colon, which is prolapsed. There is no evidence of an appendix.

Fluoroscopic findings. Head of the barium column in the ascending colon, large amount of barium in terminal coil of the ileum obscures the appendix. Appendix not shown.

Physical examination. Appendix, positive tenderness, right kidney prolapsed, nocturnal enuresis, skin, mildly, slight acne.

Case 2. Age 9 years. *Röntgenologic findings.* Barium in transverse colon: at the six hour roentgenograms Appendix distinctly shown crossing the ileum one half inch from caecum. Ileal stasis.

Fluoroscopic findings. Barium in the transverse colon and ascending colon. There is a dilatation of the terminal portion of the ileum. The appendix crosses the ileum about one half inch from the ileo-caecal valve and then passes over toward the median line. There is an area of constriction at the point where the appendix crosses over, but it is doubtful whether this is organic or spasmodic.

Physical examination. Appendix, negative.

Case 3. Age 12 years. *Röntgenologic findings.* Cap shown distinctly. Two and one half hour roentgenograms show the barium in the terminal ileum and the stomach incompletely evacuated. Six hour roentgenograms show the stomach completely evacuated. The appendix is not shown.

Fluoroscopic findings. The caecum is incompletely filled. A dilated coil of ileum lies to the left of the caecum and the appendix shows distinctly, passing downward and to the right in a semi-circular manner. The appendix itself is extremely tender and sore like a boil.

Physical examination. Appendix, positive, active inflammation.

CASE 26 Age 16 years *Röntgenologic findings* Cap shown distinctly. Two and one half hour roentgenograms show the head of the barium column in the terminal portion of the ileum, with a slight trace of the chyme in the stomach. Six hour roentgenograms show the stomach empty, with the head of the barium column in the first portion of the transverse colon, which is prolapsed. Appendix shown distinctly.

Fluoroscopic findings The cæcum is well filled. The appendix is incompletely filled, except when the barium is pushed into it from pressure on the cæcum. After the release of the pressure, the appendix vacates itself so that it is difficult to observe it.

Physical examination Appendix, negative.

CASE 24 Age 9 years *Röntgenologic findings* Cap shown distinctly. Two and one fourth hour roentgenograms show the barium in the ileum. Six hour roentgenograms show the head of the barium column in the transverse colon and the cæcum well filled. The base of the appendix is shown distinctly.

Fluoroscopic findings The cæcum ascending and transverse colon are filled with the barium, and there is a small trace of the chyme in the ileum. The appendix shows distinctly, is hook shaped with the hook pointing toward the right and remaining constant. Pressure on the cæcum failed to distend the lumen of the appendix. The hook of the appendix is retrocæcal and shows very distinctly when the cæcum is pulled upward and to the left.

Physical examination None made.

CASE 27 Age 11 years *Röntgenologic findings* Well-defined cap and pyloric sphincter. There is a spasm of the pyloric end. Two and three fourths hour roentgenograms show a fleck in the region of the appendix. Six hour roentgenograms show the head of the barium column in the transverse colon and the tail of the column in the cæcum. The appendix is shown indistinctly to the left of the cæcum.

Fluoroscopic findings There is a small fleck of barium apparently about one half inch below the cæcum. This has the appearance of a fleck in the appendix, although upon manipulating the cæcum, which is freely movable none of the barium can be forced into the appendix. However one can definitely say that this fleck is in the appendix. The entrance of the ileum into the cæcum is distinctly shown and apparently is normal.

Physical examination Appendix, negative.

CASE 9 Age 7 years *Röntgenologic findings* Cap not shown. Two and one half hour roentgenograms show the head of the column in the terminal portion of the ileum. Six hour roentgenograms show the head of the barium column at the splenic flexure. There is a dilated coil in the terminal portion of the ileum. The base of the appendix is shown and possibly the tip to the left of the dilated ileum.

Fluoroscopic findings The cæcum and ascending colon are well filled. Without any manipulation one is able to detect the appendix passing out to the

left of the cæcum. There is a kink in the center of the appendix, which is shown very distinctly upon manipulation.

Physical examination Slight tenderness in right quadrant.

CASE 22 Age 11 years *Röntgenologic findings* Cap shown distinctly. Two and three fourths hours roentgenograms show the head of the column in the terminal portion of the ileum, and the stomach empty. Six hour roentgenograms show the head of the barium column in the sigmoid and the tail of the column in the cæcum. The appendix is shown distinctly.

Fluoroscopic findings The head of the barium column is in the sigmoid. The ileum is completely evacuated, and the ascending and transverse colon are incompletely filled. There is a segmented area in the region of the appendix which is constant, but the dilated portions between the segments are larger than are shown in an ordinary appendix. The local point of tenderness is directly over this segmented area. There is some question as to whether or not this is the appendix.

Physical examination Appendix slight tenderness.

CASE 20 Age 12 years *Röntgenologic findings* Cap shown distinctly. Two and three fourths hour roentgenograms show the head of the column in the ileum. Six hour roentgenograms show the head of the column in the transverse colon and the tail of the column in the terminal portion of the ileum. The appendix is not shown.

Fluoroscopic findings The cæcum and ascending colon are well filled. There is a moderate dilatation of the terminal portion of the ileum. The entrance of the ileum into the cæcum is well shown. There is no evidence of an appendix. However, pressure and manipulation on the cæcum expels the contents into a retrocæcal appendix which is entirely behind the cæcum.

Physical examination Appendix marked tenderness.

CASE 16 Age 7 years *Röntgenologic findings* Pyloric end of the stomach incompletely filled. In the two and three fourths hour roentgenograms the head of the barium column is in the terminal portion of the ileum. Six hour roentgenograms show a dilatation of the terminal ileum, with the head of the column in the ascending colon. There is no evidence of an appendix—probably obscured by the dilated ileum.

Fluoroscopic findings The cæcum is well filled and there is a considerable dilatation of the terminal portion of the ileum—greater than in any of the preceding cases. The entrance of the ileum into the cæcum is well shown. There is no evidence of an appendix. Upon manipulation, the expulsion of the barium from the cæcum shows a retrocæcal appendix, passing out to the right across the ileum about one half inch from where it joins the cæcum.

Physical examination Appendix, slight tenderness.

CASE 11 Age 8 years *Röntgenologic findings* Cap shown distinctly. Two and three-fourths

hour roentgenograms show a retention of the barium within in the cæp. At this time the head of the caecum was the terminal portion of the ileum. Six hour roentgenograms show the head of the column in the ascending colon. The appendix is shown distinctly and is dilated and angulated.

Fluoroscopic findings. The caecum and ascending colon show distinctly. The appendix is observed upon manipulation and is well filled.

Physical examination. Appendix, negative.

Case 12. Age 9 years. *Röntgenogram findings.* Cap and duodenum shown distinctly. Stomach shown to be empty in the two and three fourths hour roentgenograms, and the barium is accumulated in the ileum. Five and three fourths hour roentgenograms show the head of the column in the ascending colon and there is a dilatation of the terminal portion of the ileum. The patient moved in these last roentgenograms. The appendix is not shown.

Fluoroscopic findings. The ileum is empty, the caecum is well filled, the appendix is observed upon manipulation but it shows much more distinctly when the barium is expelled from the caecum. It has a cork screw appearance passing either upward or downward, probably the latter.

Physical examination. Appendix very slight tenderness.

Case 21. Age 7 years. *Röntgenogram findings.* Cap shown fairly distinct, as is also the sphincter. Two and three fourths hour roentgenograms show the head of the column at the hepatic flexure and the tail of the column is the jejunum. Six hour roentgenograms show the barium in the caecum ascending and trans portion of the transverse colon. A kinked appendix lying to the right of the caecum shows distinctly.

Fluoroscopic findings. The caecum was completely filled. The appendix shows distinctly without manipulation passing to the right and with a loop passing upward.

Physical examination. Appendix very slight tenderness.

Case 12. Age 7 years. *Röntgenogram findings.* There is no evidence of the cap. Two and three fourths hour roentgenograms show the stomach is completely evacuated and the barium scattered through the jejunum and ileum. Five and three fourths hour roentgenograms show the head of the barium column in the transverse colon and the tail of the column is a dilated cæcocolic ileum. The caecum is well filled. The base of the appendix shows distinctly.

Fluoroscopic findings. Considerable local retention caecum shows distinctly. A line which is fairly characteristic of an appendix is well shown but manipulation fails to tell of its location. That is probably the appendix. The patient complains of considerable pain in this region when pressure is exerted.

Physical examination. Appendix tenderness.

Case 1. Age 12 years. *Röntgenogram findings.* Evidence of a kinked appendix.

Fluoroscopic findings. The caecum and lower part of colon are well filled. There is no evidence of an appendix.

Physical examination. Appendix, negative.

Case 14. Age 8 years. *Röntgenogram findings.* No evidence of cap. Duodenum shown distinctly. Five and one half hour roentgenograms show the head of the barium column in the caecum. The appendix is not shown.

Fluoroscopic findings. Appendix, extremely difficult to find.

Physical examination. Appendix, negative.

Case 4. Age 10 years. *Röntgenogram findings.* Five and one fourth hour roentgenograms show a collection of barium in the caecum. The appendix is well shown.

Fluoroscopic findings. The caecum is filled. There is some evidence of barium in the base of the appendix.

Physical examination. Appendix, negative.

Case 13. Age about 7 years. *Röntgenogram findings.* Cap incompletely filled. Duodenum shown distinctly, especially in the one and one half hour roentgenograms. Four and one fourth hour roentgenograms show the barium in the terminal ileum. Barium not advanced enough for appendix to be shown.

Fluoroscopic findings. No evidence of appendix, probably obscured by ileum.

Physical examination. Appendix, slight tenderness.

Case 5. Age 11 years. *Röntgenogram findings.* No evidence of appendix in any of the roentgenograms.

Fluoroscopic findings. The barium in the caecum shows distinctly, as it does also in the appendix which is of medium size. The appendix is mostly of greater and lesser density in various areas and at certain periods of the examination the apex of the appendix is well filled. At times there appears to be motion in this organ, but I am not absolutely certain that this is in consequence of the peristalsis of the adjacent viscera. After manipulation of the caecum at which time the appendix is well filled, the tendency to an evagination of the appendix is evident.

Physical examination. Appendix, slight tenderness upon deep pressure.

Case 3. Age 12 years. *Röntgenogram findings.* Stomach and first half of appendix shown distinctly in the roentgenograms.

Fluoroscopic findings. No roentgenogram seen upon this. *Physical examination.* Appendix, negative.

Case 15. Age 12 years. *Röntgenogram findings.* So much is completely filled. Two and one half hour roentgenograms show the barium well through the terminal portion of the ileum which is dilated. Five and one fourth hour roentgenograms show that some of the barium has entered the caecum and that the caecum has not advanced. The appendix is not shown.

No fluoroscopic examination.

Physical examination. Appendix, marked tenderness.

The relative frequency with which involvement of the appendix and adjacent structures is encountered in young children is at once apparent from a thoughtful analysis of the foregoing report. Clinically, our case reports when obtainable refer in most instances to such an early life history, in whole or part as follows. Cross peevish and colicky babies, later gastric and gastro intestinal disturbances, facial pallor, especially about the nose and mouth — halo oris, œsophageal, gastric, and duodenal spasm — “belly and side-aches, bilious attacks, fever spells,” nausea, sometimes vomiting, in fact all the typical evidences by the laity, attributable to “worms”, nervous manifestations, frequently convulsions, unhealthy general appearance, acne, erythema, and other cutaneous suggestions of “auto intoxication,” all of which are of clinical significance, regardless of local pain or tenderness. Obviously, of greatest importance is the early recognition of the initial lesion, which, we feel justified in believing to be essentially that of early life, developmentally or inflammatory.

In determining these and allied conditions the fluoroscope affords our only certain avenue of intelligence, for by methods devised and employed in modern roentgenoscopy we believe a more accurate knowledge of conditions within the abdomen may be acquired than by even exploratory incision, incidentally, supporting a conservative regard against possible or needless risk.

Our efforts have thus far dealt mainly with functional activities of the appendix to establish which we have reviewed the subject of the mechanical factors of the adjacent structures, and in our clinical roentgenological, and fluoroscopical reports we have given, briefly, evidences which suggest that the same principles obtain within the appendix musculature as elsewhere along the intestinal tract, and therefore command the same recognition.

Our observations confirm the inferences of Keith, and as suggested by Prof Berry, viz,

that the appendix is a specialized part of the cæcum, and we believe its relation, functionally, with the structures of the ileocæcal region of no less importance. We have demonstrated within its musculature a definite sphincteric and peristaltic function as observed both clinically and fluoroscopically (Case 2). It is likewise apparent that, in the normal appendix, faecal material is retained during quiescence of the cæcum and adjacent viscera, i.e., from one period of digestion to another, and thus, inferentially, that these retained “faecal molds” (not long-retained, dried out, or inspissated), may, or do become, incidentally or purposefully, a culture medium providing automatically fresh bacteria for colonic digestion, in brief, that the appendix is a normal physiological “culture tube.”

If as we have endeavored to show, the appendix is possessed of the specialized functions as described, are we not including a potential factor to post-operative ills, in the employment of the usual method of its removal? We are supported by Dr Ochsner in the belief that not the slightest portion of the sphincteric structures should be invaginated, a careful resection being the method of choice.

I desire in conclusion to acknowledge the service of Dr Edward Archibald, whose insistence and counsel inspired these efforts. Especially would I express my appreciation of the interest and collaboration of Drs Cole and Ochsner, by whose indulgence, corroborative evidence has been made possible.

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APOPLEXY

SUGGESTIONS FOR MORE RATIONAL METHODS OF DEALING WITH INSTANTANEOUS INTRACEREBRAL HÆMORRHAGE BASED UPON THE PATHOLOGICAL AND PHYSIOLOGICAL FEATURES¹

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SPEAKING generally apoplexy may be considered as an acute pathological process associated with a more or less general intracranial physiological disturbance—rapid or gradual in its progress which may terminate fatally, and with disturbances of function due more directly to the local effects of the lesion such as hemiplegia, hemianopsia and the like possibly entirely potential at first.

The arteries to the lenticular nucleus and external capsule are small branches arising chiefly from the middle cerebral a short distance from its origin with some assistance from the anterior and posterior cerebral. One of the larger of them runs along the outer side of the lenticular nucleus where it is covered with the external capsule—a disposition which may have something to do with the occurrence of the larger hæmorrhages so likely to take place just outside this nucleus and into the substance of the hemispheres. The arteries of the optic thalamus arise from the posterior communicating or the posterior cerebral. The larger hæmorrhages spring from these sources.²

The incidence of rupture follows closely the order of arterial diseases, viz favors so strongly the arteries of the central ganglia as to occur in the lenticulo striate and lenticulo optic arteries in 75 per cent (Durand Fardel) of such cases.³

Brissaud⁴ graphically shows the arrangement of these important arterial branches and their relation to the outlying structures.

Edes⁵ has compared the locations of intracerebral hæmorrhages in their order of relative frequency giving the Durand Fardel and Boston City Hospitals records together see Table I.

The size of such cavities may vary from pea size to that of a whole hemisphere. The larger hæmorrhages may be found in the region of the central ganglia (Hypophern)

and centrum semi-ovale while the cortex, pons and cerebellum usually harbor the smaller lesions.

The lesion is nearly always solitary when due to diseased arterial walls (Charcot), and the intra arterial pressure, transmitted directly to the cerebral tissue, forms an hæmorrhagic cavity either by *destructive laceration* when we may expect the contents of the cavity to be composed of blood and lacerated cerebral tissue, by *simple pressure without destruction* the contents then being pure blood, or by a combination of both such processes (5).

TABLE I

	Percent Total	Number Cases
Corpus striatum and optic thalamus together	22	4
Corpus striatum	13	10
Optic thalamus	5	3
Corpus striatum optic thalamus and middle lobe	2	1
Corpus striatum optic thalamus and a considerable portion not well defined of the hemisphere	15	2
Corpus striatum optic thalamus with posterior lobe	1	
Corpus striatum and middle lobe	1	3
Corpus striatum with a considerable portion of hemisphere	5	1
Corpus striatum with an extended portion of base of ventricle	1	
Optic thalamus with middle lobe	1	1
Optic thalamus with posterior lobe	1	
Middle parietal lobe	12	1
Sphenoidal lobe of middle lobe (temporal)	1	1
Anterior frontal lobe	11	5
Posterior occipital lobe	10	5
A not well determined extent of one hemisphere	8	5
The upper part of the hemisphere (one with corpus striatum)	1	1
Insula		2
Cortex not further located		1
Small multiple		1
Meninges exclusively	11	2
Ventricle	6	2
In the middle and right lobe	6	
In the middle and left lobe	5	1
In the extended middle lobe	1	
In the posterior parietal zone	11	1
In a lateral part of the hemisphere		1
In external capsule beneath ventricle		1

Based on the American Neurological Society, September 1905.



Fig 1 Cross section of right brain at genu showing relation of insula to basal ganglia and capsule. Needle passes through corpus striatum into capsule



Fig 2 Reconstructed brain showing needle passing into lateral cerebral fissure about junction of this fissure and projected Rolandic fissure a, Lateral view b posterior view c anterior view (Dotted line leads to outer end of trochlear)

Farther reaching than the boundaries of the cavity itself are the effects of the hæmorrhage. The walls of the hæmorrhagic cavity, whether pressed aside or lacerated show hæmorrhagic infiltration which may be quite marked enough to simulate in the immediate vicinity, smaller separate hæmorrhages (6). Peripheral to the walls a reactive inflammation occurs, and serous infiltration and œdema may be quite marked. Microscopically, the tissue here shows not only these processes, but also frequently damaged and lacerated nerve elements. *Further away the nerve tissue may be not actually destroyed, but may be subjected to pressure which temporarily at least, may cause physiological inhibition which further may lead to permanent pathological destruction should the pressure persist.*

The destruction or interruption of the nervous conduction paths or the ganglia themselves due either to laceration or to pressure will lead eventually to secondary trophic degeneration which in turn terminates by supplementing sclerosis for normal tissue along the tracts distal to the destruction lesion.

When the hæmorrhage passes beyond certain close confines the general intracerebral pressure may be great enough to force the cortex firmly against the inner cranial surface and obliterate the convolutions and sulci or similarly, the falx may bulge toward the op-

posite side. A cavity in the state of formation may burrow in various directions possibly breaking through the ventricle or toward the cortex or into the crus cerebri.

The original seat of the hæmorrhage, then may be in the striate body or in the optic thalamus, or in the internal capsule. It may burst through the ganglionic boundaries and involve the capsule secondarily in its destructive lesion with a resultant hemiplegia. The cortex may be involved in the process. The excavation may proceed to the ventricle and break through its walls, causing diplegia or some of the serious results of intraventricular hæmorrhage, the optic radiation may be destroyed so should life persist hemianopsia will result. The nuclei of the cranial nerves may be disturbed or destroyed and secondary degeneration occur should the hæmorrhage course toward the crura and pons, while hæmorrhages of greater size which may involve the larger part of the whole hemisphere may permanently destroy or throw out of gear the whole cerebral mechanism.

Apart from the symptoms of actual destruction we must consider interference with physiological functions due to pressure, inflammatory reaction, œdema, anæmia, or infiltration which may project similar symptoms and from which complete recovery is possible should the inciting cause be removed. We must conceive that functional disturbances of neighboring structures, disturbances due to nutritional disorders, anæmia, and mechanical causes which may become pathological and permanent if the causative factors persist, may be interrupted in their existence by the removal of such elements and the existing conditions improve, while the secondary sclerotic changes may be obviated or partially obviated.

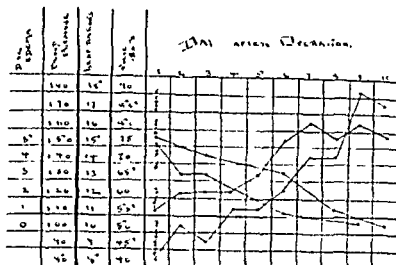


Fig. 1. Chart showing changes in pulse rate and blood pressure, respiration and diastolic oedema starting at a time immediately before operation and running to the tenth day after operation.

Cases in which hemiplegia exists under such circumstances are not out of the range of possibility -- where the potential paralysis may be avoided entirely -- cases which clear up more or less rapidly, either partially or almost completely, indicating the presence of neighborhood pressure with physiological inhibition rather than destructive lesions of the capsule itself. We may argue that in the cerebral tissue, irritation, inflammation, oedema, pressure, and infiltration may secondarily lead to sclerosis and destruction far reaching in their effects. May not the removal of the clot, the presence of which may cause the reactive oedema and pressure do away far more surely with the disturbing reaction and its serious secondary results?

Persistence of hemorrhage in the cerebral tissue may mean a continuation of the cerebral excavation and this in turn means that the dangers of a large hemorrhage involving ventricles, nuclei, optic tracts, cortex etc. threaten. In such an event an opening or safety valve may entirely obviate these sequelae.

Destruction, then, may not be benefited directly by operative means, but potential destruction, at least may be warded off by (1) relieving pressure oedema infiltration

or reactive inflammation, which if persistent may and usually will transform physiological disturbances into pathological destruction; and (2) by forming an artificial opening to the end that excavation may be stopped, and pontine, cortical, ventricular, and paths other than the drainage sinus may no longer be the *via minoris resistentiae*.

Perhaps more important in the consideration of spontaneous intracerebral hemorrhage are the disturbances of intracranial pressure. With the arterial pressure no longer confined by the vessel walls, transmitted to the cerebral tissue direct and thence to the whole intracranial contents we are confronted with a condition somewhat analogous to that seen in the case of a growing brain tumor. As the intracranial space is encroached upon the pressure is conveyed to the various portions of the cerebrum, and the brain substance suffers from pressure anemia. Reactive oedema may occur adding its part to the already increasing intracranial pressure.

At this period we may expect disturbances of function in the cardiac, respiratory and vascular centers. Under such conditions also we may expect and do find the usual symptoms and signs met with in other con-

ditions which cause this intracranial pressure (Edema of the discs (an extremely important diagnostic aid), a decreasing pulse rate, and slowed, perhaps stertorous, respiration together with a rising blood pressure, portray rather vividly the intracranial picture. The pressure anæmia of these vital centers leading to protective reaction in the general system, raises the general blood pressure and forces blood more successfully through the compressed cerebral arteries, thus counteracting temporarily, at least, the anæmia of the centers. Finally, unless the existing disturbances subside, death will ensue unless the balance of pressure lies with the general blood system and remains high enough to tide over the abnormal conditions. Once the intracranial pressure has become so great as not to allow enough blood, even under the greatly increased general pressure, to be conveyed to the centers, the result is fatal.

To recapitulate, then, we are dealing with spontaneous intracerebral hæmorrhage associated with (1) a condition of general increased intracranial pressure causing anæmia of the centers which may lead to death immediately or in the course of days, and (2) local destructive action of the blood under pressure with its immediate local effects and its delayed indirect effects. To combat these conditions, indications point toward (1) removal of the general pressure on the cerebral vessels, and (2) removal of the clot.

The muscle-splitting operation with vertical division of the temporal fascia, separation of the fibers of the underlying muscle and exposure of the underlying bone according to the method first devised by Cushing are the first steps involved.

With the trephine and rongeur an opening is made in the skull at a point corresponding to a surface projection of the basal ganglia (7) and insula and the dura exposed. Inspection of this latter may reveal subdural hæmorrhage, should the blood have excavated out through the cortex and absence of brain pulsation. A cross incision is next made in the dura and the flaps reflected. Cortical inspection may be of great importance. The presence of cerebral edema, a tendency for the brain to herniate through the opening an



Fig. 4. *a* Left central facial paralysis showing as patient attempts to smile three days after operation, *b* seven days after operation. Note marked improvement.

increase in cerebro-spinal fluid and the signs of hæmorrhage either cortical or subcortical, should be ascertained at this step. Whether the hæmorrhage is approaching the cortex or not is to be determined, as the method of operative approach may depend entirely upon this. Localized edema or a discoloration or swelling or differences in consistency may indicate that hæmorrhagic excavation is taking place in this or that portion of the exposed cortex. With this hint an exploratory puncture may be made with a trochar and blunt obturator. Should this reveal the presence of an hæmorrhagic cavity this may be dealt with by guiding a small rubber drain in along the tract of the trochar after slowly evacuating the clotted and semi-clotted blood from the cavity if this be possible. The drain is brought out through the skin opening and removed as indications warrant, during the early convalescence probably in the first few days. Procedures are more complex where the cortical inspection does not point to the location of the hæmorrhage. Under such circumstances, it has seemed that exploratory cerebrotomy in the region of the corpus striatum and other basal ganglia (see preceding table) should be the procedure of choice. Sections of the brain it will be noted (Fig. 1) indicate that the shortest path to the striate body is by way of the island of Reil. Theoretically at least this would appear to me the most promising avenue of approach. This leads to a consideration (1) of the physical difficulties in approaching the surface of the insula and (2) of the

physiological characteristics of the intervening tissue

Reconstruction of our brain sections indicate that the needle should pass almost directly in at about the junction of the projected sulcus centralis with the lateral cerebral fissure (Fig 2). This involves careful separation of the edges of the operculum and guiding the needle into the depths of the lateral fissure taking extreme care that the middle cerebral artery in its course upward is not injured. This step will be the more easy as the separation of the temporal convolution (superior) from the upper opercular borders is the greater.

According to Dana, in the thalamic symptoms proper, central pain, anaesthesia, and hemianopsia are to be expected. The two latter may occur from extrathalamic lesions. Observations suggest vasomotor, temperature, and disturbances of the visceral centers in extensive lesions of the thalamus. The pain is usually in the arms and hands, next in the leg and foot and rarely in the head may be intense and is always on the paralyzed side. It is more a burning discomfort than a sharp aching pain. Dana has not noticed the paralyses of emotional expressions in any of his strictly thalamic cases.

Tendency of investigations indicate that the thalamus is essentially an organ for the reception and distribution to the cortex of sensory centers for vision, hearing, smell, equilibrium, and deep and superficial sensibility.

Sachs concludes the thalamic syndrome is characterized by (1) a slight persistent anaesthesia, (2) a slight hemiplegia usually without contractures and rapidly egressive, (3) a slight hemiataxia and a more or less complete astereognosis, (4) sharp pains on the hemiplegic side often persistent, paroxysmal, and intolerable, and (5) by choreic and athetoid movements on the paralyzed side.

Further views on the basal ganglia are numerous. Southard (8), Rhein (9), Rhein and Potts (10) and others have collected interesting data and much literature on the function of these bodies, tremors, sensory disturbances, and hyperkinesia being among the symptoms attributable to their distur-

bances. Others believe that the proximity of the internal capsule is, at least, partly responsible for some of the symptoms ascribed to the ganglia.

The basal ganglia, and the island, the claustrum, and the external capsule, the other structures involved in this approach, can hardly be considered as obstacles when compared from a functional standpoint with the internal capsule.

Having encountered the insular cortex the needle, with the trocar in place, is carefully inserted a short distance, the obturator removed, and if no hemorrhage is encountered the needle is pushed deeper. In this manner, hemorrhage is sought for both in the island, in the claustrum and external capsule before the striate body itself is explored. At a depth of between 1 and 2 cm, the end of the trocar will encounter the corpus striatum. Here, one must be careful that no clotted blood nor portions of brain matter clog the opening and screen the lesion. Should the findings be negative we may either guide the needle a fraction of a centimeter deeper into the internal capsule and thence into the ganglia bordering the inner side of this structure or we may attempt another puncture after removing the needle completely.

Exploration of the lateral ventricles, best following the lateral approach of Keen (11) which may be utilized in this field, may be an extremely important step especially in the presence of marked hyperpyrexia, and if the hemorrhage has not been located elsewhere, as the frequency with which the hemorrhage may burst through the basal ganglia into the ventricles — and the presence of intraventricular blood may be of very serious import — is somewhat underestimated.

In dealing with hemorrhagic accumulations one must be careful to use drainage material, if this be necessary which will cause the least reaction such as rubber or gutta percha.

In a case lately operated upon by us we were able to locate, upon cortical inspection, the hemorrhage which had broken through the insular cortex and appeared between the boundaries of the lateral cerebral fissure. In this case the cavity was about 4 cm in diameter, and extended deep into the ganglionic

area. Hence, in this case ganglionic puncture was unnecessary. Drainage together with the relief of the intracranial pressure by forming a decompressive opening in the manner aforementioned changed this condition of almost certain death to an almost normal state in the course of a few days, as will be seen by the following data:

This patient came to us six days after the onset in a comatose state with left hemiplegia. The classic signs of increased intracranial pressure, and the steadily progressing features of the case were important operative indications. Following the operation the disc œdema dropped from 5D to normal, blood pressure dropped from 156 to 110, respirations rose from 8 to 18, and the pulse rate increased from 56 to normal (Fig. 3). The facial paralysis cleared up quite markedly (Fig. 4), and the leg paralysis cleared moderately, while the arm showed improvement. This case, however, had suffered from pressure for six days before relief, and it was doubtful in our mind whether the local destruction of the motor paths could be bettered at this late stage, yet the rapid clearing up indicated that the removal of the clot had had a beneficial effect. Two weeks after operation the patient was in excellent condition and walking about with some difficulty. As it might be expected in case of such standing better results can be expected in the relief of the general pressure than in the ganglionic exploration together with drainage, since the length of time elapsing between the onset and operation was great enough for the at least partial metamorphosis of physiological disturbances into destructive lesions.

Procedures such as have been suggested should be rapid and accurate. Careful hand-

ling of the cerebral tissue, delicate manipulation in inserting the drainage material, the application of the proper methods to avoid shock, careful technique, the administration of urotropin, and care in the after-treatment are presupposed.

Under the present technique, it is hardly to be considered that the dangers of operative procedures in such cases would overbalance any good that might ensue. It is hardly to be denied that the decompressive features of this operation as a life-saving measure are advisable (12). Whether the ganglionic exploration will be successful in alleviating the paralyses, as appears possible, can only be determined when this procedure has been applied to a larger series of cases and at earlier stages in the course of the affliction.

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CHORDOMA, WITH THE REPORT OF A MALIGNANT CASE FROM THE SACROCOCCYGEAL REGION

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A CHORDOMA is a rare tumor. In searching the literature I am able to find reports of but fifteen cases.

Therefore it is of interest because of its rarity. It is of still more interest because of its origin from notochord (chorda dorsalis) structure. Until recently it was regarded as a pathological curiosity. Recent cases, including the one which we shall report, indicate, however, that chordomata are also of clinical interest and importance.

Clinical history. A male, age 26, white, an American, was referred to the University Hospital at Iowa City, by Dr F H Kisor, Kalona, Iowa, May 19, 1913. The entrance complaint was—pain in the rectum and difficulty of defecation.

Family history, negative.

Past history. Patient has had measles and chickenpox. He denies having had syphilis or any previous bowel trouble. He is an abstainer of alcoholic liquors and uses tobacco moderately. In other respects the past history is also negative as regards the condition in question.

Present illness. On February 22, 1913, he was in a railroad wreck during which he sustained a fracture of the collar bone and received bruises on the head, right leg about the calf and about the coccyx.

He had a dull aching pain in the coccygeal region ever since the injury. For some time the pain was not increased by bowel movements. About May 1, 1913, about 9 weeks after the injury, the pain became worse and was increased at the time of bowel movement. At the same time he began to have difficulty of defecation and the faces were blood stained. The symptoms became rapidly worse and on May 19, three months after the injury, he came on the advice of his physician to the University Hospital for operative relief. On examination a tumor mass, protruding forward from the posterior wall of the lower part of the rectum, was found. It seemed to occlude the lumen of the rectum to about two thirds of its extent. It did not appear to be adherent to the coccyx nor to any other portion of the vertebral column.

The tumor was excised by Dr. William Jepson, the excision being made by way of an incision which extended from the anus to the tip of the coccyx. This relieved the obstruction. The patient improved rapidly and for a while did not require medication to secure movements of the bowels.

The patient left the hospital eight weeks after the operation, feeling that he had made a fairly good recovery although he was never, neither before nor since leaving the hospital, entirely free from a slight rectal discharge of pus and blood, nor was he ever entirely free from pain which was increased during acts of defecation.

Two months after leaving the hospital, the pain, discharge of pus and blood, and difficulty of defecation, all became worse. On the advice of his physician, he returned to the hospital. On examination, which caused the patient considerable distress, a nodular and somewhat ulcerated mass extending around the rectum in an annular manner and causing considerable constriction of the lumen of the rectum, was found. The mass was not movable. The X-ray examination was negative as were also the Wassermann, blood and urine examinations. A portion of the mass was removed for microscopical examination. This indicated as did the examination of the first specimen, that it was a chordoma. Dr W R Whiteis then performed a radical operation—Tuttle's modification of the Kraske operation—and removed three inches of the tumor involved portion of the rectum. The growth was again found to be non adherent to any portion of the vertebral column. The operation relieved the symptoms of obstruction and the patient improved for a while. Before long, however, there was a recurrence of the tumor with a return of the symptoms. These became progressively worse. Obstruction finally necessitated the performing of a colostomy which was done on March 26, 1914, 11 months after the tumor was first noticed by Dr C J Rowan. The incision was made just to the left of the left border of the left rectus. The peritoneal cavity was opened. The tumor was found not to have extended upward along the rectum very far. From this time on the bowel contents were evacuated through the artificial anus thus produced. The patient became more and more emaciated and otherwise rapidly failed in health. He left the University Hospital June 9, 1914 and died a month later (July 10, 1914). It will thus be noticed that death occurred 14 months after the tumor was first recognized. No autopsy was secured.

Gross pathology. The piece of tissue removed at the time of the first operation was an oval shaped mass which measured 10 x 6 x 5 cm. Its surface contour was rather ragged. The cut surface indicated that the mass removed was made up in largest part of intestinal wall tissue surrounding the tumor mass. The tumor proper was, apparently,

fairly well defined from the surrounding tissue and occupied principally the submucosa. At one place it was covered by normal mucous membrane, at another place the mucous membrane had disappeared, leaving an ulcer. The muscularis was partly invaded by the tumor and partly pushed backward by the growing mass.

The tumor mass proper was 5.5 cm long 4 cm wide, and 2.5 cm thick. The tumor was very soft in consistency and of a light color. It was made up, for the most part, of rather homogeneous material, although there were numerous small holes varying in size from those just visible to those which measured one millimeter in diameter. These contained a soft jelly like substance.

Microscopic pathology. The microscopic picture is rather striking and quite characteristic. The most obvious and diagnostically important feature is the presence of large vacuolated cells which tend to break up forming a foamy substance. The cells occur in groups or columns, which are separated from each other by an interstitial substance which is quite homogeneous. Here and there are distinct bands of fibrous connective tissue. In the muscularis, the muscle fibers are separated by the infiltrating tumor cells.

The following description is based on the study of a section stained with haematoxylin and eosin. The tumor cells proper are large epithelial like cells with a small, deeply staining nucleus and a large amount of faintly staining vesicular cytoplasm. Most of the cells are in a degenerated vesicular, or vacuolated state. The few cells that seem to be intact, are rather isolated and present a fairly distinct outline and a granular cytoplasm. Cells in all stages of disintegration are present. Those which are but slightly involved are larger than the intact cells and present one or a number of clear areas—vesicles. When there is but one vesicle, it may be of large size causing the nucleus to be flattened and crowded to one side of the cell giving to it the appearance of a fat cell. More often the vesicles are multiple. For a while the cell outline seems to be retained. Later with the increase in the size of the vesicles the cell outline becomes broken up, until finally we find a number of nuclei lying in a foamy mass of protoplasm with no cell outlines distinguishable. The changes described also occur in normal notochord cells, as they become mature. The larger of these areas of broken down cells represent the small cysts recognizable with the naked eye. The intact cells measure from 6 to 10 and the vesicular disintegrated cells from 10 to 18 microns in diameter.

The interstitial substance between the groups and columns of cells is rather homogeneous taking a diffuse red stain with eosin. This is the substance that gives to microscopic sections of the tumor its cartilaginous appearance and which caused Virchow to regard the tumor as cartilaginous in nature. The amount of interstitial substance varies greatly in different parts of a section—in some places it is

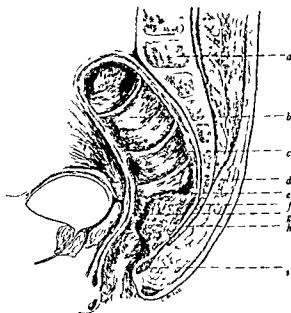


Plate 1 Fig 1. Illustration representing the position, relative size and general relationship of the chordoma to the surrounding tissue.

a Sacrum b rectum c mucous membrane of the rectum, d longitudinal muscular fibers of rectum e circular muscular fibers of rectum f chordoma g ulcerated surface of the chordoma, h coccyx i internal sphincter muscle.

in excess of the cellular elements, in others, it is greatly overshadowed by the latter. The interstitial substance consists partly of mucin as we shall note later.

The fibrous connective tissue is arranged in bands between large areas of tumor substance. This tissue appears to be for the most part but incidentally present representing the connective tissue which was present in the normal tissue before its invasion by the tumor. The same explanation applies of course to the muscle fibers which are present.

Microscopically there is distinct evidence of malignancy as indicated by the infiltration of the adjacent muscle tissue without any attempt at capsule formation.

Sections stained by Mallory's aniline blue method reveals certain features not so well brought out in sections stained with haematoxylin and eosin. The vesicles of the large tumor cells take a light bluish stain. The foamy substance formed from the breaking down of cells takes a somewhat more intense blue stain as does also the more firm intercellular substance. At first thought, this was believed to represent collagen fibrils. It does not however, occur in bundles of wavy fibrils such as the latter usually form. It appears to be principally mucoid in nature or at least in places contains

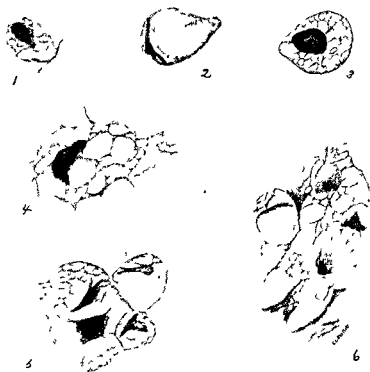


Fig 2 (1) Intact chordoma cell (2) Chordoma cell with a large vesicle in cytoplasm (3) Chordoma cell with a number of small vesicles in cytoplasm (4) Chordoma cell with indistinct cell outline due to vesicular disintegration of the cytoplasm (5) A group of chordoma cells showing marked vesicular change of the cytoplasm (6) A mass of chordoma tissue consisting of a number of indefinitely outlined nuclei in a mass of foamy substance which represents the vesicular disintegrated cytoplasm of a number of cells

mucin, as indicated by its taking a reddish stain with thionin. The tumor contains no substance that reacts to fat stains.

CHORDOMATA GENERAL DISCUSSION

It is now very certainly established that a chordoma is a tumor consisting of notochord (chorda dorsalis) tissue. This belief is based on the location of the tumor and on the similarity of histological structure. The notochord originates as a pouch from the entoderm, pushes upward and comes to lie just ventral to the neural tube. It represents the first axial skeleton. Around it is later formed the bodies of the vertebrae and the posterior portion of the base of the skull. The notochord extends from the lower part of the vertebral column up to the juncture

of the occipital and sphenoid bones. It disappears from the bodies of the vertebrae during foetal development but frequently remains as a small pulpy mass the nucleus pulposus, in the intervertebral discs. Occasionally also, masses of notochordal tissue may be found anterior to the bodies of the vertebrae or as a small nodule in the *clivus blumenbachii*, projecting upward from the sphenoccipital synchondrosis.

Virchow (1) who first recognized the small masses of notochordal tissue in the *clivus* regarded them as tumor-like proliferations of vesicular degenerated cartilage cells from the synchondrosis in question and gave to such the name — *echondrosis physalifera*, because of the vesicular cells surrounded by

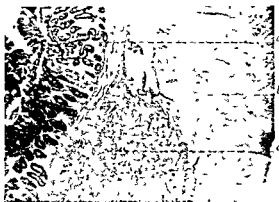


Fig 3 Photomicrograph (low power) representing the chordoma invading the submucosa and muscularis of the rectum a, Mucosa, b, muscularis, c chordoma

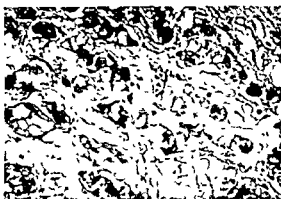


Fig 4 Photomicrograph (high power) of chordoma showing intact cells vesicular cells in all stages of disintegration and intercellular substance

a matrix of what appeared to be hyaline cartilage

Mueller (2) was the first to express the view that these nodules had their origin from rests of notochordal tissue

Ribbert (3) more conclusively proved that such was the case and gave to the process the name chordoma. He found that these small nodules not larger than a pea were of frequent occurrence being found in about 2 per cent of all autopsies. These small nodules do not produce any clinical symptoms.

In the light of our present knowledge we do not regard these small masses as true neoplasms. They are rather to be explained as masses of notochordal tissue possibly hyperplastic, that have been forced out of the bone during the process of fetal development.

Grahl (4) reported the first case of chordoma which produced clinical symptoms. This tumor was located at the base of the skull in the clivus Blumenbachii. It was a definitely circumscribed tumor the cut surface of which measured $2 \times 3.5 \times 3.5$ cm and which was attached by a pedicle to the sella turcica. There was compression of the adjacent cranial nerves which had resulted in symptoms of paralysis.

Fischer (5) was the first to report a malignant chordoma. The term malignant is here used in the pathological sense in that the tumor was of an infiltrating character.

Klebs (6) was the first to report the oc-

currence of a tumor like nodule of notochordal tissue away from the usual location at the base of the skull. In this case the mass grew anteriorly from one of the cervical vertebrae.

Mazzia (7) was the first to report a case of true chordoma growing elsewhere than at the base of the skull. The location was the sacral region.

To date I have found reports of fifteen cases of what may properly be regarded as chordomata. The one which I report is the only one which has a history of traumatism that appears to be quite directly connected with the development of the tumor. If such a relationship exists it is not probable that the traumatism has in this case caused any displacement of a portion of the notochordal tissue that remained in an intervertebral disc. It is much more probable that the trauma may have excited to growth, a rest of notochordal tissue that had been displaced into the soft tissue of the posterior wall of the rectum during the period of fetal development. The lack of connection between the tumor and any part of the vertebral column would tend to favor that view.

SUMMARY AND CONCLUSIONS

1 Chordomata are tumors of interest because of their rarity and their origin from notochordal tissue, they are also of importance because of the clinical symptoms which they produce.

2. Nodules of notochordal tissue, not exceeding a pea in size, are found in about 2 per cent of all autopsies (Ribbert). These do not produce clinical symptoms and are not to be regarded as true neoplasms

3. Including the one here reported, sixteen well recognized cases of chordomata have been reported to date

4. Of the sixteen cases reported, ten had their origin from the base of the skull in the region of the spheno-occipital synchondrosis, six developed in the sacrococcygeal region

5. Of the sixteen cases reported, ten were pathologically malignant and six, benign, although some of the latter caused death by virtue of their location. Of the malignant ones, six had their origin from the base of the skull and four, from the sacral region

6. In two of the cases reported, the tumors appeared to be entirely independent of the vertebral column or base of the skull suggesting their origin from rests of notochordal tissue displaced during the time of foetal development

7. Traumatism appeared to play a direct rôle in producing the tumor in one of the cases (Albert)

In conclusion, I desire to thank Drs Kisor, Jepson, Whiteis, and Rowan for the clinical history of the case, and Drs. Royce, Grover, and Bartlett for assistance in the making of histological preparations, photomicrographs, and drawings

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DEPARTMENT OF TECHNIQUE

A NEW OPERATION FOR UMBILICAL HERNIA

By F. G. DUBOIS, M.D., F.A.C.S., SELMA, ALABAMA

A STUDY of the pathological anatomy of umbilical hernia and of the surgical principles at present adapted for its cure reveals an inefficiency of treatment as demonstrated by 15 per cent of recurrences. A review of the works, very early by Richet and recently by Moschcowitz, leaves but little to seek in its anatomical description. There appears to be a lack of appreciation of the rôle played by the tendinous and ligamentary supports of the umbilical fascia in the production of recurrences after operation. The linea alba at the junction of the third tendinous intersection of the recti is pierced by four apertures which normally close when the cord is tied at birth. The fibrous remains of the obliterated vessels entering these openings assume a new and different anatomical form and function, the umbilical vein becoming the round ligament of the liver, being incorporated in and forming a part of the suspensory ligament of the liver. The urachus and the umbilical arteries pass downward underneath the peritoneum following its reflection back of the symphysis pubis, joins, and acts as supports to the bladder, the urachus to the fundus and the arteries laterally. A dissection of these obliterated vessels

demonstrates firm attachment to the fascia posterior to the pubes, it is convincing that from this fixed point to the umbilicus these three cords pull the umbilical fascia downward and backward. The round ligament of the liver exerts traction upward and backward on the umbilical fascia, its name has a tendency to obscure its dual function. The umbilical fascia is situated in the linea alba where the fusion of aponeuroses and fascia makes this area the most fibrous and least muscular portion of the abdominal wall occupying the center of a tendinous cross, one arm being formed by the linea alba the other by the transverse tendinous intersections of the recti.

The elements entering into the formation of the umbilicus or Richet's fascia are of structural interest, anatomically this fascia is reinforced in its entirety by interlacing transverse fibers (Richet). The openings for the exit of fetal vessels are infundibuliform, so that when cicatricial closure has

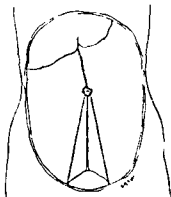


Fig. 1. Diagrammatic illustration of umbilical ligaments.



Fig. 2. Cross section showing lines of traction exerted by umbilical ligaments.

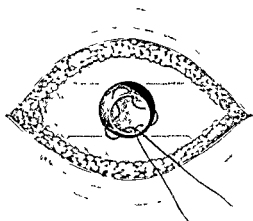


Fig 3 Purse string suture in stump of hernial sac dotted lines indicating proposed transverse parallel incisions

occurred it is overlaced with fascial tissue in covering the openings (Moschowitz).

There are six lines exerting traction on the umbilicus. It is a physical fact that the varying angles of traction thus exerted on this fascia make it normally an unyielding plane offering a maximum of static resistance to abdominal forces at this point. From without in the structures of the umbilicus are superficial cicatrix, fascia with four areas of imbedded cicatricial tissue, and peritoneum, thus differing from other parts of the abdominal wall in the absence of skin, subcu-

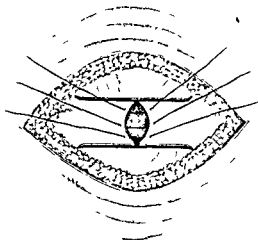


Fig 4 Lateral flaps mobilized, sutures inserted

taneous fat, two layers of superficial fascia, and of preperitoneal fat

The pathogenesis of the congenital type or true omphalocele is from arrest of development, the umbilical ring failing to close.

Moschowitz demonstrates plausibly that the acquired form arises from a gap between the upper margin of the umbilical ring and the umbilical vein, the smaller amount of adventitia in the umbilical vein as compared with that of the umbilical arteries diverging below, and to the dense fusion of the obliterated ends of the arteries and vein filling the lower part of the um-

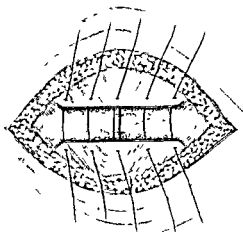


Fig 5 Sutures inserted in upper and lower edges of aponeurosis

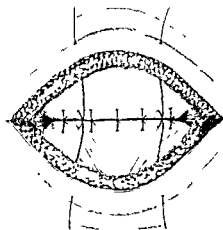


Fig 6 Closure of superficial aponeurotic layer, with figure-of eight sutures inserted

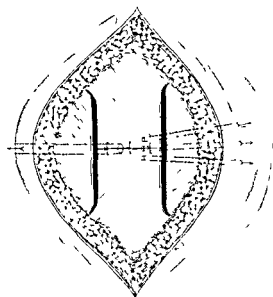


Fig 7 Diagrammatic illustration of lines of traction exerted by umbilical ligaments, and their restoration after sutures in first aponeurotic flaps are tied

bilical ring with connective tissue, making it relatively stronger than the upper part, a hiatus being favored at the point of lesser resistance.

The surgical principles involved in the operation for the radical cure of umbilical hernia should provide for the attachment of the umbilical ligaments at a point in the suture lines so that the pull exerted by them does not favor gaping, and should readjust the lines of traction, so that the effect of the pull will be to close rather than to open the lines of union in the reconstructed aponeurotic wall.

A transverse skin incision is made elipsing the

protrusion, in the obese taking in a larger area of skin and fat, thereby reducing for cosmetics and comfort the pendulous and redundant tissue. The neck of the sac is isolated, opened, and its contents freed and returned into the abdomen, it is then amputated, and the peritoneal edges everted and approximated by a running mattress or purse-string suture. A transverse incision is made at the upper, and a parallel incision at the lower margin of the umbilical ring, thus mobilizing two lateral fascial flaps to be united by interrupted sutures. Running in the long axis of each flap is the third tendinous intersection of the rectus abdominis muscle. The edges of the upper and lower lines of incision are brought together by interrupted sutures, thus forming a double aponeurotic wall, with lines of approximation at right angles. Two figure-of-eight silk worm-gut sutures are introduced as shown in the drawing, going deeply enough to catch the underlying fascial flap, and brought out through the skin an inch from the margin of the incision. When these are tied they relieve the strain in all directions on the aponeurotic lines of union and close the dead space in the subcutaneous fat.

On the posterior surface of the lateral aponeurotic flaps is the attachment of the umbilical ligaments. When the inner ends of these flaps are sutured together the hernial opening in the umbilical ring is closed and the attachment of the round ligament of the liver above and of the urachus and the obliterated umbilical arteries below are restored anatomically. All traction exerted by these ligaments pulls on the upper and lower ends of the line of approximation of the two lateral flaps, thus having a tendency to close and not to pull apart the sutured edges of these two flaps.

From one to three years have elapsed in six cases operated on by this technique without a recurrence.

INTRATRACHEAL ETHER ANÆSTHESIA: A NEW APPARATUS AND INTRATRACHEAL TUBE¹

By SAMUEL ROBINSON, M.D., F.A.C.S., ROCHESTER, MINNESOTA

From the Mayo Clinic

AFTER a thorough trial the intratracheal method of administering ether anæsthesia has justified its existence. There is but one contra-indication to its use, namely, the presence of a profuse purulent bronchial secretion. The method is particularly indicated in

- 1 Resections of the upper or lower jaw
- 2 Resections of the tongue and floor of the mouth
- 3 Operations on the brain
- 4 Plastic operations on the face
- 5 Laryngectomies
- 6 Difficult tonsillectomies requiring careful dissection
- 7 Operations for cleft palate
- 8 Removing tumors of the wall of the chest which involve the pleura
- 9 Exploratory thoracotomies in the absence of pleural adhesions
- 10 Transpleural operations on the heart and œsophagus
- 11 Extensive plastic procedures for chronic emphysema when there is restricted respiratory function
- 12 Operations on the lung in certain rare instances

The definite reasons for the applicability of the method in the above mentioned instances are as follows:

1 In certain operations on the head it is convenient and desirable to dispense with ether masks, cones and inhalers which tend to soil the sterile field of operation and since they must

necessarily be removed intermittently, uneven and generally insufficient anæsthesia results.

2 To remove the anæsthetist from the immediate field permits greater accessibility, thus facilitating the work of surgeon and assistants, and diminishing the possibility of errors in the technique of asepsis.

3 The somnulent, peaceful breathing coincident with intratracheal etherization is accompanied by the minimum amount of congestion of the blood-vessels of the head; hæmorrhage is thus favored.

4 The inhalation of blood, mucus, infectious material, and bits of tissue not uncommon in routine operations about the mouth and a possible source of complications, is prevented to a considerable extent by the outflowing escape of air around the intratracheal tube.

5 In certain thoracic operations already mentioned in which a free pleural cavity is to be widely opened, it is advisable, and on occasions imperative, to assist the respiratory function by insufflation of the lungs. If the intratracheal tube is already being employed for anæsthesia the additional features of insufflation may be added promptly by certain adjustments in the apparatus.

6 The lungs of certain patients with chronic emphysema are restricted in aerating surface. The necessary cramped posture on the operating table further limits the expansion of the better lung. During extensive plastic operations on such patients cyanosis is of common occurrence.



Fig. 1. A. An intratracheal tube. A modification of a type of urethral catheter. B. Olive-tipped tempered steel stilette to guide intubation. C. End of tracheal tube. Hollow cup at tip for olive stilette. Two side eyes.

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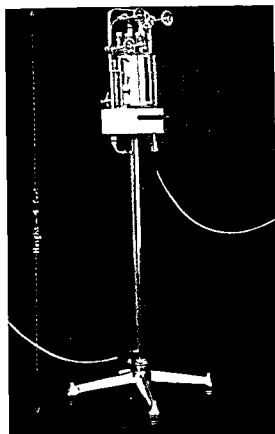


Fig 2 An ether vaporizing apparatus for intratracheal anesthesia

The insufflation incident to intratracheal anesthesia accelerates the tidal air exchange, thus relieving cyanosis.

The tube may be introduced into the trachea by any one of several methods:

1. A laryngeal speculum preferably of the Jackson type may be used to lift the epiglottis and to illuminate the vocal cords, between which the tube may be directly introduced, an excellent method requiring limited paraphernalia, slight change of posture, and moderate experience in the use of the speculum.

2. A hollow steel introducer (Cotton) of a caliber sufficient to contain the tube may be used to guide the tube across the mouth and pharynx and to point its tip in the direction of the vocal cords.

3. A woven catheter may be passed directly into the larynx by sense of touch. This procedure, owing to the absence of any guide is

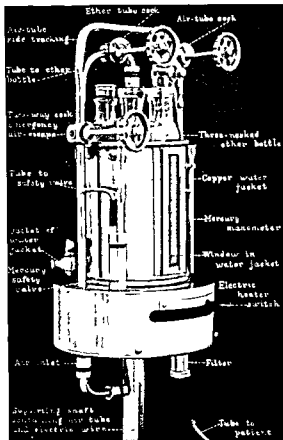


Fig 3 Ether vaporizing apparatus showing details of upper portion

difficult of execution. Trauma may result both from the introduction and from the presence of a stiff-walled tube within the trachea.

After sufficient experience with the above methods I came to these conclusions: (1) That direct vision is not essential for prompt intubation, and that the speculum is therefore superfluous; (2) that the hollow steel introducer is an insufficient guide to the tip of the tube; (3) that a tempered steel stilette within the lumen of the tube and reaching to its very tip serves as a more effective guide; (4) that an inlying soft rubber tube might cause less irritation to the tracheal membrane than a woven catheter.

Slight alterations in a certain type of stilted soft rubber urological catheter were sufficient to provide the tube and stilette (Eynard) Fig 1. The lumen of the tube is of greater proportionate diameter to the outside diameter of the tube than is found in the usual soft rubber urethral

catheter. There are two side eyes, provided as a safeguard against obstruction to the inflowing air and ether. The tip of the tube (Fig. 1C), is made hollow and provides a hollow cup to retain the olive tip of the steel stylette, while the urethral catheter is generally solid at the tip, the lumen terminating in the side eye. These tracheal tubes are now manufactured in sizes from 21 to 24 F.

Technique of intubation. The stylette is bent to a curve adapted to the patient to be intubated. It is then smeared with a thin coat of vaseline and inserted into the tube, care being exercised that the olive tip of the stylette is implanted accurately in the cupped end of the tube (Fig. 1C). The tube is stretched gently along the shaft of the stylette and held thus by the spring grip of the stylette handle (Fig. 1A). The outside of the tube is then lubricated.

The patient lying in the flat dorsal posture is anesthetized to the point of complete muscular relaxation. The head is raised with a two inch pillow and so placed that the face points directly upward. The intubator stands at the patient's right, the assistant opposite. The jaws are well separated with a side mouth gag. The tongue seized with rubber tipped tongue forceps is drawn forward. The assistant holds the gag in his right hand, the forceps in the left. The intubator then inserts his left forefinger into the pharynx and lifts the epiglottis forward. With the right hand he gently introduces the styletted tracheal tube across the mouth and pharynx, with care that the plane of the tube is accurately in the median line. He then causes the tip to pass behind the forefinger now supporting the epiglottis. If properly directed the tube meets obstruction at this point. The vocal cords will approximate themselves in response to the irritating contact with the tube end. Gentle manipulation is indicated here. Trauma only increases the spasm of the cords. Suddenly the tube should slip between them, at which moment the patient unless very deeply anesthetized will cough spasmodically. This alone is ample evidence that the tube has entered the larynx. With the handle grip released the stylette is cautiously withdrawn with the right hand, the left synchronously sliding the tracheal tube over the stylette into the trachea. Under deep anesthesia or previous laryngeal cocaineization the entrance of the tube may cause no reflex spasms. Doubt may thus arise as to whether the tube is in the trachea or the esophagus. The intubator then places the oral end of the tube against his cheek. If the tube is in proper position he will

note intermittent breaths escaping from it synchronous with expiration. Meltzer refers to this as an unreliable test explaining that an esophageal breathing also occurs and may produce the same phenomenon. Therefore he suggests that the tube be conducted well down into the throat. If it meets obstruction at a deep level it may be concluded that the trachea has been entered and that the obstructing element is the bifurcation, at which moment it is withdrawn two inches to its proper final position. If on the contrary no obstruction is met in this experiment it is presumed that the tube has entered the esophagus. Experience nevertheless soon teaches one to gather definite and prompt conclusions as to the success of his intubation from the aggregate indications.

If the intubation has prompted spasm and coughing, it is sometimes preferable to reapply the ether mask or cone for a minute before connecting the vaporizing apparatus with the tube.

Vaporizing apparatus. There are many forms of vaporizing apparatus to provide anesthesia when connected with an intratracheal tube. They vary in size, design, mechanism, and cost, but from the point of view of adequacy of function, they may be said to be equally efficient. Certain features in the vaporizing machines, once regarded as essential, have proved to be superfluous.

1. It was supposed that the entering air and ether mixture must be moistened by passing through water, thus supposedly imitating a function ordinarily performed by the pharynx. Apparatus devoid of such water baths have now long been used without harm and with equal efficiency.

2. The earlier machines were fitted with connections to warm the entering mixture of ether vapor. It has since been shown that it is not only quite impossible to accomplish this but also that a mixture arising from a volume of liquid ether the temperature of which has been lowered sufficiently to cause frosting on the outside of its glass container, is yet harmless to the air passages.

3. Heat devices are yet employed in apparatus to prevent too great a lowering of the ether temperature. The object of this however is solely to facilitate the vaporizing of the ether and thus to economize in the amount of the liquid consumed.

4. Bacterial filters were advocated, but there is no evidence that the use of machines not thus provided has resulted in any untimely effects.

Therefore, simplicity of design and increasing lack of cumbersomeness in apparatus has resulted from six years of clinical application of this interesting method of anæsthetizing.

The apparatus illustrated in the accompanying photographs (Figs 2 and 3) is remodeled from

one previously described by the writer.¹ There are no particularly original features in its construction and yet it is presented because it has proved itself in a series of three hundred cases to be safe, useful, and reliable.

¹Apparatus for thoracic surgery under intratracheal insufflation or positive pressure, etc.

AN OPERATION FOR THE CURE OF HERNIA BETWEEN THE ABDOMINAL RECTI¹

By WILLIAM EDWARD FAIRFIELD, C.M., M.D., F.A.C.S., GREEN BAY, WISCONSIN

SEVERAL years ago a woman came to me who had an enormous hernia amounting almost to complete eversion, and which had followed a central laparotomy. I operated and reoperated without success until I devised the procedure I am about to describe, and which gave me a cure. I have operated upon several patients since that time without failure in any case, and I offer my technique to the members of this society in the hope that it may meet with the approval of those who have had indifferent results from other forms of intervention.

Dr Howard Kelly of Johns Hopkins Medical School, from whom we always expect the best and who never disappoints us, describes in his *Operative Gynecology* an operation for hernia in which he excises the fibrous ring surrounding the hernial opening, and exposes the muscles.

He then advocates suture by layers, and he includes with the sutured internal fascia the muscle fibers of the recti. I think this present technique accomplishes muscular interposition and utilizes muscle tonus much more effectually, and it further simplifies the problem of bringing like tissues into contact. When the ring of fibrous tissue is cut away and the muscles exposed it is quite a difficult matter to suture fascia to fascia, because of the tendency of muscle to bulge and interpose itself, and the further tendency of the underlying fascia to retract beneath the muscle. Again when the fibrous ring is first excised and the cut edges of the fascia united, virtually the same condition obtains which was present when the hernia occurred (if the hernia is post-operative) and the very tissue it is essential to use in relieving the tension which leads to tearing out the stitches is thrown away.

The tough and fibrous character of the material composing the ring is admirably adapted to the anchorage of tension sutures. The method of

suturing here described is not only simple, but it is also practical, being similar to the steps of an ordinary suture gastro enterostomy.

First, let us consider the factors present and operative in the production of this form of hernia. If one will study the anatomy of the abdominal wall, it will be quickly understood that division of the fascial linea alba removes the one anchor opposing the side pull upon the recti. All of the muscles have a transverse pull upon them, and as soon as the fixed point is destroyed there is nothing to counter-balance this pull.

I have found that most post operative herniae of this type give a history of severe vomiting, often lasting for days after the original operation was performed. Is it any wonder that herniae result from such effort? The binder and like devices may prevent protrusion of the abdominal contents, but they do not prevent the divergent lateral pull put upon the recti, and the result is a gradual separation, widest at the center and often drawing the muscles over almost to the crest of the ilia, leaving an unprotected space in the center, through which a ventral hernia must occur.

I believe that the practice of overlapping fasciae in the treatment of hernia is wrong in principle, because fascial tissue will not unite to fascia when it is laid flat upon it, except where sufficient trauma has taken place to provoke a fibrous union. The tendency of these structures is to resist union and to continue to slide upon each other, as they were originally intended to do. When cure results from such a disposition of tissues it is largely an accident dependent upon trauma to the superimposed layers — if we may except the Mayo operation for umbilical hernia in which a natural physical tendency is overcome by an ingenious displacement of tissue — but success in this procedure depends little upon firm union. It is a shingling operation.

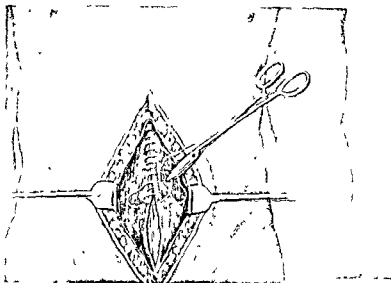


Fig 1 Peritoneum closed Uncut muscle sheaths being united by continuous suture suture.

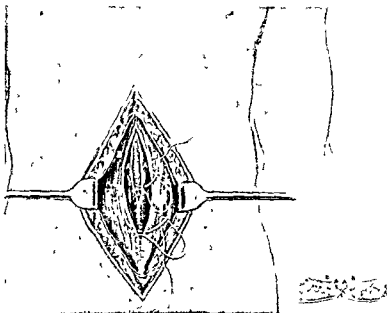


Fig 2 Fascia split parallel to line of union and inner flaps *II* being united by a continuous catgut suture Outer flaps *BB* also being united Insert does not show the second line of sutures as it should

This operation is applicable to all forms of separation of the recti muscles whether post-operative or not, and the procedure is the same in all cases

The operation depends essentially upon the conversion of the two fascial spaces containing the recti into one space, obliterating thereby the natural separation of the two muscles, and in

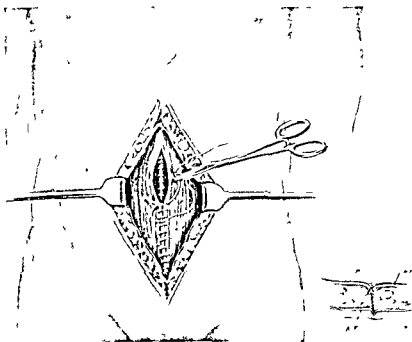


Fig. 3 Union of flaps which completes the essential steps of the operation
Tension sutures not shown

terposing both muscles over the hernial point. An incision is carried down to the hernial sac, and a dissection is then made outward until the recti are exposed on either side. One must not become discouraged while doing this dissection. The recti will usually be found lying near the ilia at their center, but they are constantly found in their normal positions above and below the hernial opening. These muscles are enclosed in a thick fascia formed by the aponeurosis of the internal and external oblique. It is necessary to remove all the attached fat from the fascia, and for this purpose a gauze sponge is admirably adapted.

The peritoneal sac is now opened and as much of it is cut away as is necessary. On some occasions I have made an opening in the sac and have then run a purse-string suture around the portion I judged should be removed. With the suture in place, the central portion of the peritoneum is cut away with scissors and the purse-string drawn tight and tied. When a linear incision is made it is closed with a Cushing catgut suture.

Next the two recti are approximated by the application of a running catgut suture through the fascia covering the internal edges of the recti sheaths, much the same as we insert the first row

of stitches in a gastro-enterostomy. The stitches should be four to the inch and should include the whole thickness of the fascia.

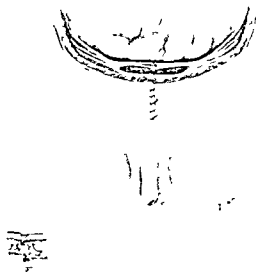


Fig. 4 Cross section showing operative scheme

The fasciae covering the muscles are now split the whole length of the wound, and about one-fourth of an inch external to the central union made by the running suture. The inner fascial flaps are then united to each other by a fine running suture of catgut, just as in the second step of a gastro-enterostomy.

Next, the outer flaps are united to each other, which procedure completes the essential step of the operation, namely, the placing of both recti

in one compartment. Figure of eight silkworm-gut sutures are made to include the skin and subcutaneous structures. The lower half of the "8" passes deeply through the recti, and acts as a tension suture. These are placed about an inch apart.

The ends are threaded upon a short section of small rubber tubing and tied. The patient is kept in bed for three weeks, and wears a binder thereafter only if she has a pendulous abdomen.

BULLET REMOVED FROM BRAIN AFTER SIX YEARS

By ERNEST MAMMEN, M.D., F.A.C.S., BIRMINGHAM, ILLINOIS

ON March 8, 1909 Z. B., age 21 years, was shot at short range by a thirty-two caliber revolver. The bullet entered the cranial cavity at the right temporal ridge about one and a half inches anterior to a line drawn perpendicular to the meatus auditorius and about one and a half inches above its level. The patient received an extensive fracture of the skull at this point and in its track the bullet produced serious laceration of all membranes and brain tissue, penetrating the falx cerebri to the opposite side. The impact split the bullet so that one half was found imbedded in the temporal muscle near the point of entrance. The patient was carried some sixteen miles to the hospital. There was severe hemorrhagic shock, as well as destruction of brain tissue. Half of the bullet together with splinters of bone and loose brain tissue were carefully removed and the cavity packed with strips of gauze. The prognosis was bad.

However, there was prompt recovery with but few complicating symptoms. About the seventh day the patient escaped from the hospital under the delusion that he must get somewhere else and away from home. He was brought

back and full explanation made to him, which he understood. Thereafter he remained contentedly at the hospital until his discharge. He recalls these circumstances to the present day.

About 1912 an epileptic seizure occurred in the daytime. This was followed by several others more severe than the first. I advised taking a skiagram for the purpose of locating the remaining half of the bullet. This was done by Dr. H. L. Potter, of Chicago, and the bullet found located in the left anterior fossa of the skull, within the brain tissue, somewhat below a horizontal line from the point of entrance and on the opposite side as shown by the accompanying cut. The patient was advised to have the bullet removed but declined.

No further epileptic attacks occurred until March, 1915, when a series of them caused him to again seek my



Fig. 1. View from right side



Fig. 2. Posterior view of location of bullet

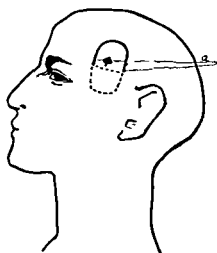


Fig 3 Drawing showing shape of incision (a)

advice. I again proposed skiagraphing the head for the purpose of determining whether or not the bullet had changed its position. This was done by Dr H W Grote, of this city, and the bullet located in practically the same position it held three years ago. Anteroposterior skiagraphs as well as lateral stereoscopic views showed the bullet to lie about half an inch within the brain substance exactly upon the margin of the left wing of the sphenoid, or just within both the anterior and the middle lobes of the brain. This time the patient consented to have the bullet removed. The operation was done June 3, 1915—nearly six years and three months after the accident.

The diagram illustrates the incision used. It is that of an inverted U. The lower arms beginning on a line about on a level with the location of the bullet. Small trephine openings were made at the beginning and termination of this incision and the rest of the bone opened in the usual manner with rongeur forceps. The door thus made was turned down and the dura incised. Careful exploration located the bullet exactly as shown by the skiagram. Over its location the dura had become firmly adherent to the skull. In fact at this point the membranes were all coherent and a fibrous envelope surrounded the bullet penetrating its irregularities so that in the removal there was some, though not extensive, laceration. The patient recovered

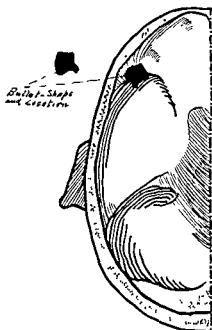


Fig 4 Drawing of cross section showing location and shape of bullet

promptly, after a few days of difficulty in articulating and in writing. He made incoherent sounds but was unable to produce syllables. Gradually he recovered ability to pronounce one syllable. When told to write his name or the name of his town or any other word he would write each time the same word, which was "thynd," but there was no mental impairment. There was stiffening of the muscles of the lower jaw and of the sternomastoid and its associated muscles of the neck. In three days, however, he was perfectly able to write, and his speech had improved so that he could pronounce words of two syllables. The location of the bullet was thus shown to be in the track for coordination of control of the muscles of speech and of control of the muscles employed in writing. All aphasic symptoms passed away and he was discharged on the 10th day after operation, perfectly well.

A MODIFIED MCBURNEY INCISION FOR THE TREATMENT OF APPENDICITIS AND PELVIC DISEASE

By ANTHONY H. HARRIGAN, M.D., New York

Assistant Visiting Surgeon, Fordham Hospital

IT occurs not infrequently that during the performance of an appendectomy in the female, the surgeon discovers unexpectedly a pathologic condition of the uterus, fallopian tubes, or ovaries which requires operative attention. Assuredly, careful differential diagnosis, and the habitual use of bimanual pelvic examination under narcosis, should reduce this unanticipated finding to a minimum.

No technical difficulty exists if a right rectus vertical incision be used. The simple prolongation downward will afford sufficient exposure of the female pelvic organs. However, when the operator has selected the intermuscular incision of McBurney, a serious predicament arises. This incision does not give, ordinarily, sufficient room to attack complicated inflammatory lesions in the female generative organs.

In order to meet this dilemma the writer recommends the following modifications of the McBurney incision. No claim is made for originality, as the procedure is based on the ingenious operations of Weir and Fowler, which were devised to extend and to enlarge the intermuscular incision.

It is essential to recall the anatomy of the

anterior rectus sheath. At this level it is formed by the union of the aponeuroses of the internal oblique and transversalis muscles, merging with the aponeurosis of the external oblique. Numerous observations on the living, confirmed by cadaver dissection, demonstrate that the aponeurosis of the external oblique fuses with the combined aponeuroses of the internal oblique and transversalis muscles at a variable point. As a rule, the line of juncture is well to the inner side of the outer border of the rectus muscle. The immediate line of contact is by loose areolar connective tissue, which is readily severed. The line of fascial adhesion is oblique, passing from above downward and inward toward the pelvic origin of the rectus muscle.

Keeping this anatomic point in mind, the operation may be described as follows:

a. After removal of the appendix through the intermuscular appendix, suture the peritoneal opening and the transversalis and the internal oblique muscles.

b. Prolong the skin incision downward and inward toward the median line.

c. Divide the aponeurosis of the external oblique to the point where it fuses strongly with the anterior rectus sheath.

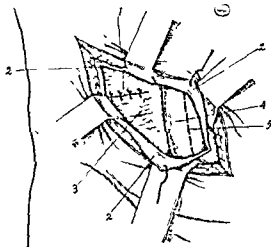


Fig 1 (1) Internal oblique and transversalis muscles sutured, (2) external oblique aponeurosis incised to its insertion in sheath of rectus, (3) internal oblique muscle, (4) sheath of rectus, (5) incision in sheath of rectus.

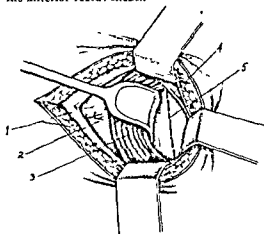


Fig 2 (1) Skin, fat, and external oblique muscle, (2) internal oblique muscle, (3) rectus retracted outward, (4) cut edge of rectus sheath retracted, (5) incision through peritoneum.

d. Incise the anterior rectus sheath parallel to the line of fusion of the aponeurosis of the external oblique muscle, leaving a sufficient margin internally to suture.

e. Free, displace, and retract outward the rectus muscle.

f. Incise the peritoneum.

g. The closure is simple. Following the suture of the peritoneum the rectus muscle is replaced, and the sheath sutured. The external oblique muscle is sutured with a continuous catgut suture and the skin margins approximated in the usual fashion.

The advantages are the employment of one incision for the combined operation, which is desirable when the patient has not been informed of the likelihood of a second operation. No muscles or nerves are divided, complete anatomic restoration of the abdominal wall is obtained. A possible objection is an unduly long skin incision. This can be materially shortened by shifting and sliding the skin incision downward and maintaining the displacement with retraction. The writer has had no difficulty in removing adherent and fixed inflammatory tubal and ovarian masses through this incision.

THE USE AND ABUSE OF LANE PLATES

By JACOB FRANK, M.D., F.A.C.S., CHICAGO

THE introduction of Lane plates in the operative treatment of fractures was a notable addition to our armament in caring for such conditions. The immediate acceptance by the surgical profession of this method was due in part to the distinction made between functional and anatomical results secured by the hitherto routine non-operative treatment of fractures, a distinction brought in the foreground by the marked development of roentgenology and its application to this branch of surgery. We all know that a good functional result is not always entirely dependent upon a good anatomical result, as shown by the X rays nor is the reverse true. Nevertheless, the lay mind, influenced by the visions of proceeds resulting from malpractice suits, often confuses the two and thinks they are interdependent, in which opinion he is supported only too frequently by members of the legal profession. The desire to secure good results, both functional and anatomical, therefore, was the immediate *vis a tergo* behind Lane's method in its adoption as a standard method of the treatment of fractures.

The gradual advancement in our aseptic surgical technique has widened the scope for the operative treatment of fractures, so that one school—that of Lane—even advocates the open reduction of all simple fractures. It is only fair to state that many are of the opinion that operative treatment should be applied only in the exceptional case. Nevertheless, Lane's views have been adopted by the profession the world over. The application of this method by surgeons less skilled than the originator and less

cognizant of the extreme asepsis required for good results, has resulted in incalculable harm. It has fallen to my lot to get many patients previously operated upon, and presenting indifferent and bad results. I realize that patients with good results would not return, and yet, is the method as now used indiscriminately by anybody and everybody professing to be a surgeon, worth while? This doubt has led me to look up the literature on the matter.

The necessity for absolutely perfect asepsis in bone surgery is recognized as axiomatic, and yet such asepsis is not synonymous with a good result. Sheen (1) says the screws often loosen in rigidly clean cases, thus making the plating method in these cases, as far as fixation of fragments is concerned, inefficient. Hey Groves, before the International Medical Congress (1913), stated the same thing. A view on this point from Lane's clinic is enlightening. Sampson (2) writes concerning Lane's cases that the rarifying osteitis at the basis of the loosened screws *probably* does not occur without the introduction of organisms. It is to be noted that Lane himself is not certain that absolute asepsis guarantees a good result.

Needless to say, the metallic bodies binding the fragments do not form a scaffolding for the new bony growth. This is amply demonstrated by the persistent sinuses which heal only after the plate has been removed. Often enough, absorption and disintegration of the bone surrounding the plates and screws occurs. Edington (3) reports cases in which some sinuses healed after removal

¹ Italian my own.

CORRESPONDENCE

NEPHRECTOMY DURING PREGNANCY

To the Editor In the June 1915 number of SURGERY, GYNECOLOGY AND OBSTETRICS, Dr Anthony H. Hargan reports a case of "Nephrectomy During Pregnancy," and gives summaries of cases previously reported. I wish to put on record a case which occurred in my private service at the Macon Hospital. The case presented no especially unusual features so I will report it briefly.

Mrs A. R. T., age 20, was admitted to the Macon Hospital on December 21, 1913, being then five and one-half months pregnant. She gave a history of having been perfectly well until four days before admission when she was seized with a chill and intense pain in the region of right kidney. The pain had been continuous since first onset, though varying in severity. She has had several chills and her temperature varied from normal to 103°.

Examination shows a small, ill nourished woman, weighing ninety pounds. Temperature on admission, 102°. Marked tenderness present in region of right kidney, pain being severe enough to require repeated injections of morphine.

Urinalysis: Urine highly colored, specific gravity, 1.028, with a large trace of albumin and a large number of granular casts, red blood-cells, and pus-cells.

The white blood count on admission was 32,000. Twelve hours after admission the temperature went to 103.3° at which time I operated.

Operation: Mayo incision, exposing kidney. Kidney delivered and showed three or four large yellow nodules with a number of small ones. The condition of the patient was very poor, the pedicle was clamped and the kidney rapidly removed. The patient was put to bed, with Murphy drip, tap water. Recovery was normal, the temperature going up to 103°, six hours after operation, and reaching normal in 24 hours. Twenty-four hours after operation the patient's face became slightly swollen. During the first 24 hours 290 ccm. of urine was obtained, second day, 410, third day, 1200, fourth day, 1010, fifth day, 2300, sixth day, 2480. Later history: On February 7, 1914, with normal urinalysis and for no assignable reason she went into labor and was delivered of a seven months child which lived a few minutes. Since that time she has been perfectly well.

Diagnosis: Septic infarcts of the kidney.

In this case I thought there was a better chance for the patient to recover if nephrectomy were done than if nephrotomy were done. In 3 cases in the past two years I have done nephrectomy twice in ill nourished women with surgical kidneys, and nephrotomy in one instance in a strong woman three weeks post partum. All three cases made uneventful recoveries.

CHARLES C. HARROLD, A. M., M. D., F. A. C. S.
Macon, Georgia.

BOOKS RECEIVED

Books received are acknowledged in this department, and such acknowledgment must be regarded as a sufficient return for the courtesy of the sender. Selections will be made for review in the interests of our readers and as space permits.

THE PRACTICAL MEDICINE SERIES. Vol. V., edited by Isaac A. Abt, M. D. ORTHOPEDIC SURGERY, edited by John Kidson, M. D., and Charles A. Parker, M. D., Chicago: The Year Book Publishers, 1915.

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THE BOOK OF THE FLY. By G. Hurlstone Hardy. New York: Reiman Company, 1915.

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CASE 2. A L., age 30, came under observation November 10, 1914. Two months previously the patient suffered a compound fracture of the left tibia in the lower third. There was never any attempt at bony union, although apposition seemed to be good. It has always been possible to move the fragments around in any position.

A linear incision five inches long was made over the site of the fracture at about the junction of the lower and middle thirds. The periosteum was removed with a periosteome and the fractured ends of the bone were pushed through the incision. The connective tissue was cut away and the ends of the bone freshened by means of a saw, removing a small disc from each fragment. By means of the reamer the medullary cavity of the upper fragment was reamed out for a distance of three inches making a cavity half an inch in diameter. The medullary cavity of the lower fragment was reamed out for about two inches. The bones were then placed in apposition and the wound covered with gauze. An incision was then made over the opposite tibia, the periosteum removed and by means of a circular saw, driven by a motor, a bone splint measuring four inches by one-half inch was removed from the crest of the tibia.

This was trimmed off by means of the saw and introduced into the medullary cavity of the upper fragment for a distance of two and a half inches. The lower portion was found to be too long and was shortened about half an inch, and then introduced into the medullary cavity of the lower fragment. In the process of the introduction of this bone splint the lower fragment was fractured a portion being split off communicating with the medullary cavity. This was held in place however by means of a thick strand of kangaroo tendon wound around the fractured portion of the fragment as an axe handle is wound. The fragments were then brought into close apposition the fascia sewed with catgut and the skin held by skin clips. A plaster of Paris cast was applied reaching from the perineum to the web of the toes with the foot at right angles to the leg.

The work with the reamer and saw was done by Dr. Emil Hoggland, who used his electric motor and appliances.

CASE 3. M. O. male age 28 was first seen at Joliet Illinois on December 4. About two months before the patient had suffered a compound comminuted fracture of both bones of both legs in a runaway accident. He was taken to St. Joseph's Hospital and an attempt was made to reduce the fragments. The compound wounds were treated aseptically and healed kindly. As there was considerable displacement of the fragments and no attempt at bony union, open operation was decided upon and done on December 4, 1914 at St. Joseph's Hospital, Joliet. An incision over the fracture of the right leg was made for about eight inches and the fractured ends of the bone were pushed through the skin incision including the fragments. The sharp irregular ends of the fragments were sawed off squarely by means of a handsaw. A portion of the fractured fibula about three inches long was then removed, this portion of the fibula was introduced into the medullary cavity of the upper fragment.

The medullary cavity of the lower fragment was then reamed out with the burr and, by exerting traction on the lower fragment it was possible to introduce the protruding portion of the bone plug into the lower fragment. This brought the two fragments into close apposition and perfect anatomical relationship. The Lamarch bandage was removed before the incision was closed, the bleeding points ligated, the periosteum and fascia closed by catgut and the skin by interrupted silk-worm gut sutures.

An incision was now made over the fractured left tibia extending for about ten inches. The fragments were

pushed through the skin incision and sawed off as previously by means of the handsaw, so as to get square apposition. As the fibula was not readily available in this case, an intramedullary splint was made by making two crosscuts over the crest of the tibia and uniting these crosscuts by means of a longitudinal incision through the bone made by the circular saw. This gave us a bone splint about three inches long by a third of an inch in diameter. The medullary cavity of the fragments was then reamed out by the burr, the plug first introduced into the upper fragment and then, by exerting traction and manipulation, the protruding part of the plug was received into the medullary cavity of the lower fragment. The Lamarch bandage was removed and bleeding points ligated. The periosteum and fascia were closed by catgut and the skin by interrupted silk-worm gut sutures.

A plaster cast was now applied to each leg, reaching from well up on the hip to the web of the toes, the foot being held at right angles to the leg, the great toe, the inner surface of the patella and the anterior superior spine of the hum being in a line. This was done on both sides after protecting the soft tissues by dressings over the incisions and sheet wadding along the rest of the limb.

The motor saws, and burrs were supplied by Dr. Emil Hoggland.

Dr. Charles Davidson, of Chicago, who has operated upon a number of these cases, advises placing both legs in casts for four to five weeks following the operation. He has followed this practice in his own work, and in a recent conversation with him he said that he had no fractures following the removal of the bone plug.

In all probability there is a bone absorption at the site of the removal of the splint, causing considerable weakness of the tibia at this point. The suggestion has been made by Dr. Davidson, and recently carried out by him, of using a portion of the fibula upon the injured side for the intramedullary splint. This is a splendid idea and undoubtedly will be much used in the future.

It is very desirable in the performance of this operation to have suitable instruments with which to work. While it may be accomplished by a hand driven saw and reamer and by a chisel and mallet, the operation is much facilitated, and at times greatly shortened by having a good motor with which to drive the reamers and the saws. Furthermore, the danger of fracture in the process of removing the bone splint is very greatly reduced because of the lessened trauma of the motor driven instruments. A number of these are now upon the market.

In none of the cases occurring in our own service or in others observed in the wards of other men in Cook County Hospital in which the autogenous bone transplant has been used in the open operation for the fixation of fragments has any serious infection occurred and bony union of the fragments so fixed has taken place within the normal time limits for the bone in question.

To summarize

1. Foreign bodies for the fixation of most fragments in the open treatment of fractures are unnecessary

2. Non absorbable material used in the open treatment of fractures predisposes to infection and osteomyelitis, and frequently must be removed.

3. Intramedullary bone transplants, or inlays, will frequently bring about union when foreign bodies have failed to do so.

4. The time of the operation is not increased by the use of the bone transplant

5. The weakening of the bone from which the splint is removed is not a contra indication to the operation

6. The danger of infection is no more of a contra indication to operations upon bones than upon other tissues when non absorbable substances are not used for fixation purposes

TECHNIQUE USED IN APPLYING ANASTOMOTIC BUTTONS

By RICARDO FINOCHIETTO, M D, BUENOS AIRES, ARGENTINE

SINCE 1912 we have employed in the creation of neostomies, and especially in the application of anastomotic buttons, a procedure which facilitates the making of the purse-string suture. In each instance we determine definitely, by mathematical rules, the size of the incision to be made in the bowel to receive the button or catheter, and we make the field of operation completely bloodless.

The method consists in pressing between the blades of a hæmostatic forceps a designated portion of the wall of the stomach or intestine. Around the blades of the hæmostat a purse-string suture is inserted. Through the zone pressed together by the hæmostat, an incision is made, and the catheter or button is introduced into the bloodless incision.

TECHNIQUE OF THE APPLICATION OF THE MURPHY BUTTON

First step With the left hand the operator grasps from the wall of the stomach or intestine,

with a Ferner hæmostatic forceps, a fold perpendicular to the line of future incision. The size of the fold varies with the kind of button to be used. If the cylindrical button is used the amount of stomach-wall or intestine to be grasped by the forceps is equal to three-quarters of the diameter of the button. If the oblong button is used, the size of the fold is equal to one-half the great diameter of the button (Fig 1). The forceps are completely and slowly shut. The purse-string suture is started at one side of the blades of the forceps. The needle progresses with wave motion going in and coming out of the intestinal walls, taking a stitch of the desired thickness. When the top of the fold is reached, the needle is passed through it, and the suture is continued on the opposite side. After turning around the tip of the forceps, the needle is passed through the top of the fold, on this side, is brought down to the anterior side, and ends in a point near to that at which the suture started.

Second step The forceps is taken away and we find that the mucous coat in the field, which has been held by the forceps, has disappeared, the

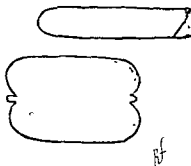


Fig 1 Showing the size of fold for oblong button

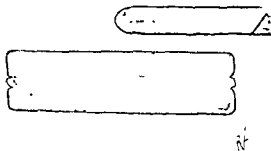


Fig 2 Showing size of fold for cylindrical button

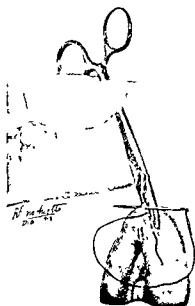


Fig 3 Intestine grasped by forceps and suture started

submucous layer with its vessels, together with the seromuscular layers, are found very much reduced. With a cut of the scissors the viscus is opened in the pressed zone. The button is placed and the purse string suture tied. It is understood that before opening the viscus we



Fig 4 Button in place and purse string suture tied

shall make certain that the bowel has been closed by one of the methods in use. It is of course known that the mucous and submucous layers of the stomach go underneath the seromusculosa with great ease.

In applying the forceps to the stomach, it is necessary that the fingers which take the fold should grasp the gut firmly, since the superficial layers have a tendency to slip from the forceps. Likewise, because of the size of the vessels of the stomach, we are obliged if we require an absolutely bloodless field to leave the forceps in place a few moments longer than would be necessary if we were working in the intestines or in the gall-bladder.

This technique is also employed with advantage in jejunostomies and gastrostomies according to Witzel's method, it is also of great advantage in applying tubes or catheters in any segment of the gastro intestinal tract.

PERINEAL SECTION IN BOYS

By WILLER VAN HOOK, M D, CHICAGO

THE necessity of making a perineal opening into the bladder in boys is less frequently met with than in men. Nevertheless, for the removal of small stones and foreign bodies or for the establishment of perineal drainage during the healing period of operations for such conditions as hypospadias, it is a necessity not infrequently encountered.

Several anatomical conditions in boys differing from corresponding conditions in later life render perineal section worthy of thought.

Differences in size are most impressive. Then the differences in development of the bladder, urethra, and all other structures need observation. Figures 1 and 2 are illustrative and suggestive.

Fortunately, the fact that the bladder in young boys is so high and that it is long and narrow is unimportant as long as we are able to pass urethral instruments into the bladder.

We do not really require an especial set of urethral instruments in order to operate in such cases. The boutonniere is made in children as follows:

A suitable sound is passed through the urethra into the bladder. While a special grooved staff would be desirable it is not necessary. It is

only a little more trouble to follow the plain than the grooved sound into the bladder from the perineum. For small boys a satisfactory staff may be extemporized by bending with the fingers a silver probe into the form of a urethral sound. If the six inch surgical probe is not large enough a silver uterine probe may be used.

This probe having been passed into the bladder, the patient being held in the lithotomy position, the perineum is distended gently by an assistant pressing the probe against it from within. To accomplish this the probe must be held strongly in the fingers and must be used like a staff to lift the soft perineal tissues away from the pelvis. The operator can usually feel the probe from the perineum.

Now the operator pushes the blade of a narrow scalpel (or of a cataract knife) into the perineum, beginning at a point from about one third of an inch in front of the anus for babies, to about one-half an inch in boys of six or eight years. One wishes to cut neither the *sphincter ani* nor the bulb of the urethra (see Fig. 2).

The knife is entered with its back upward and toward the bulb of the urethra, the edge toward the rectum. But the cutting is done at

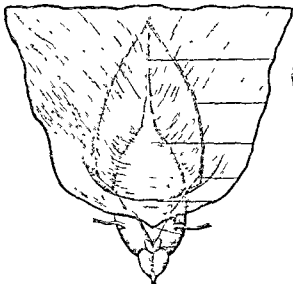


Fig. 1 The bladder, etc., in a young boy (After Poirier)



Fig. 2 This figure shows the vesico-urethral anatomy in an infant (After Merkel-Henle)



Fig. 3 Illustrating the method of holding the salt catheter

the point of the instrument. Carefully and steadily the knife is pushed inward until the approximate depth of the probe is reached. If the knife does not contact the probe, the handle of the knife may be moved from side to side while the point makes slight corresponding oscillations in the opposite directions. The hand will then feel the resisting probe through the urethra, the knife point lying within the loose areolar tissue about the urethra. When the probe is felt in this way the knife may be gently withdrawn for a slight distance and its point turned carefully toward the sound, then pressed on until it enters the urethra and grates upon the silver. Now the operator pushes forward the knife point within the urethra until a generous incision is made in the tube. No fear need be entertained as to the future integrity of the urethra; the longitudinal cut heals swiftly when the tube is removed.

The next step consists in passing into the bladder a grooved director by the side of the knife blade. The operator holds the handle of the knife in his left hand and, with his right hand, passes the grooved director along the knife blade until he feels the probe in the urethra. This means that the point of the grooved director is in the urethra. It is next pushed on until it is in the bladder.

Remember that when a grooved or hollow instrument enters the bladder, urine flows unless of course there is total absence of urine or the presence of blood clots prevents. The importance of remembering this simple rule during the heat of an operation is not to be overestimated. Even if the bladder has been emptied only a few minutes before, almost invariably enough urine will have been poured into the organ to give the diagnostic discharge.

It is now the moment to withdraw the knife and the urethral staff leaving the grooved direc-



Fig. 4 This shows a catheter introduced as a preliminary to an operation for hypospadias.

tor in place. And it remains only to push the catheter on into the bladder. This maneuver is most easily accomplished as follows.

Prepare a small, perfectly new, soft and smooth Nelaton's catheter by digging with the point of a penknife a small hollow within the solid tip of the instrument. While the catheter is held firmly in one hand the blunt end of a firm probe may be engaged in this hollow. Now the catheter being pulled back taut upon the probe, the tube and the probe may be held in the right hand as one apparatus. The probe makes the catheter a rigid instead of a flabby and loose instrument. Figure 3 shows how the device is held.

Next pass the point of the catheter thus supported along the grooved director until it is in the bladder. If desired, a little salt solution may be injected into the organ through the catheter to make sure that the drainage is perfect. If the discharge is not free the catheter is to be pushed farther in or drawn out a little until the right point is reached.

The operation ends by the passing of a strong silkworm gut suture deeply through the skin at the side of the wound through almost one-half the thickness of the catheter. The suture should be made secure by the tying of three knots.

For children the best dressing is of gauze and a heavy layer of stiff zinc oxide ointment applied freely about the wound.

Figure 4 shows the catheter in position preliminary to operation on a case of hypospadias in a six-year-old boy.

ACUTE PYELITIS: ITS DIAGNOSIS AND TREATMENT

BY KENNETH H. AYNESWORTH, M.D., F.A.C.S., WACO, TEXAS

THE literature of acute pyelitis has been rather rich during the past few years, and one finds quite a number of good articles bearing upon this subject. The literature prior to the general use of the cystoscope and the ureteral catheter is of very little value, as the methods of diagnosis then in use were necessarily quite inaccurate and often misleading. It seems proper that the term pyelitis should mean inflammation of the pelvis of the kidney and the upper part of the ureter. This inflammation, or, more accurately, the reaction from inflammation of the pelvis of the kidney, is somewhat different from inflammation elsewhere in the body. In other regions of the body inflammation almost invariably induces a local reaction, which is one of the chief aids in diagnosis. It has been my experience that acute pyelitis is rarely diagnosed correctly unless it be of a very acute type with sufficient suppuration to form small lumps of pus, which thus mechanically block the ureter or cause swelling of the mucous membrane, which starts symptoms of ureteral obstruction, or else the inflammation must be so grave as to involve the kidney substance and superinduce symptoms of acute nephritis with local pain and soreness.

The pathology of acute pyelitis is well understood, and a description is not necessary in this paper, no distinctions will be attempted between pyelitis and pyelonephritis, as the discussion has merely academic interest, neither will pyelitis from stones, kidney inflammations, etc., be discussed, as the title of the paper includes only the type usually described as acute pyelitis.

The etiology of pyelitis is the same as for any other inflammation, but the mode of its origin is very different and is worthy of careful study. Bacteriologic studies have conclusively demonstrated that the principal organism of infection is the colon bacillus. This germ produces the great majority of the infections, and general observation shows it present in pure culture quite often. The other pus-forming organisms, such as the staphylococcus, the streptococcus, the pneumococcus, and the bacillus of influenza, may be found in conjunction with the colon bacillus, or in some rare instances they may be the only organism present in an infection. In my experience the colon bacillus has always been present either in pure culture or in association

with one or more of the other pus-producing organisms. The typhoid bacillus may be the only germ present, but this is extremely rare. In cases which become chronic the colon bacillus is nearly always the only germ present, due in all probability to the fact that it tends to overgrow and crowd out other germs of less viability.

Many explanations have been given for the frequent solitary presence of the colon bacillus and for its presence with other organisms. This seems to indicate that the infection most probably comes from the intestinal tract, either directly or indirectly. Some writers, especially Weibel (1), claim that the infections by the staphylococcus and streptococcus are ascending infections and that the colon-bacillus infections are from the intestines. This explanation should be given considerable weight, for it would clarify the situation somewhat. Pathologists have classified the routes of infections into ascending, descending, and hæmatogenous infections, and those from contiguous infected tissues. Kelly (2) ascribes the great majority to hæmatogenous infection. It is quite difficult to believe this statement unless one accepts the possibility that the tissues of the pelvis of the kidney have a susceptibility to the colon bacillus, otherwise there would be many localized areas of colon bacillus infection in different parts of the body, which we know is not the case. Weibel's (1) explanation seems most plausible; he says that there is a direct lymphatic connection between the lymphatics of the cæcum and the ascending colon with those of the kidney, and that organisms can and do easily follow these paths to the pelvis of the kidney and there induce an infection. We know that many cases of pyelitis give a previous history of chronic constipation and often attacks of colon involvement have occurred just prior to the onset of pyelitis. Anything which will lower the local resistance will be a factor in making the tissues more susceptible to infection. The patients whom I have studied gave no previous history of diagnostic value, except those patients in whom local traumatism have been a factor. The enlarging pregnant uterus has been accused of being the cause on account of pressure on the ureter stopping the normal flow of urine and producing lowered vitality, thus making the tissues more vulnerable. If this were true, why have we not more pregnant patients with acute

pyclitis? If this were a factor of much weight there would be innumerable patients with this disease in every section of the country — which we all know is not the case. Then, too, why is not every patient with massive fibroids or large ovarian cysts afflicted with acute pyclitis? I have not seen such a case, and I am sure that if pressure were a real factor our patients with large fibroids would have acute pyclitis in a larger percentage than those without it. The cases of acute pyclitis of pregnancy which I have treated were in the early months of pregnancy, when the uterus was not at all a factor in abdominal pressure.

Infections elsewhere in the body might be strongly suspected of causing infections of the pelvis through the blood stream. I am sure that the previous history of some of my patients would lend support to this theory. One will be reported in detail later on. Anything which tends to block the flow of urine through the normal channel and to produce a damming up of the urine will lower the local resistance and thereby constitute a real factor in the pathology of this disease but my experience does not bear out this contention, as the majority of my patients had no interference with the urinary outflow. Of course in old prostates with urinary retention and in women with marked cystocele there are contributing factors which must be considered in discussing this subject, but entirely too much weight has been placed upon these conditions. I do not know why the pelvis of the kidney is so often affected, neither do I know why the pharynx or the conjunctiva is likewise often involved in inflammation. I am of the opinion that associated conditions are often described as causes. However, we do know that the pelvis is frequently involved in other wise perfectly healthy individuals and that almost everyone is subject to some one of the various things which have been suspected as being the cause of pyclitis, these conditions can have value only when a causative relationship can be established with some degree of certainty. We know that, in many infections, germs which have come from the kidney are found in the urine direct, and yet there is not a suspicion of pyclitis. These organisms must either come from the blood through the kidney or else get into the urinary tract somewhere else, and yet there is no infection.

Symptomatology of acute pyclitis is exceedingly interesting. In no other inflammation with which I am familiar is there such unusual phenomena of reflex symptomatology. Only with the rarest exceptions have I heard patients com-

plain of any local pain or disturbance of any kind. Of course, in those patients in whom there is involvement of the kidney substance, or some blocking of the urinary outflow, or some local injury, there is always local symptomatology. In those patients who give no local manifestations the symptoms are those of a general infection associated with frequent urination and irritable bladder. Practically every case has been diagnosed cystitis as a complication of some acute infection rather than the correct diagnosis of simple acute pyclitis. The reaction to infection, as shown by fever, rapid pulse, often chills or chilly sensations, general body aching, sometimes nausea and vomiting, are among the usual symptoms of acute pyclitis, the regional symptoms, as pertaining to the genito-urinary tract, are frequent urination with painful or at least unpleasant sensations. Some patients do not have painful urination, especially at the beginning of the attack, others suffer from the very onset of the disease. The examination of the urine will show the determinative factors to be pus, kidney epithelia, serum albumin, casts (only when the kidney is involved), generally an acid urine, and often red blood cells. The specific gravity is frequently low, due to the larger quantity of urine secreted in this condition. There is an absence of the usual bladder epithelia seen in such abundance in cystitis. I have seen frequent and painful urination some time before pus was found in the urine.

The most violent cases I have seen have been in pregnant women in whom the onset was rather sudden, with chills, high fever, local pain, and marked urinary distress. On the other hand, I have seen patients treated for typhoid fever and puerperal sepsis who had pyclitis with continuous fever of remittent type. Undetermined fever in children should arouse the suspicion of pyclitis when the other usual diseases have been excluded. R. G. Freeman (4) says that in children fever may or may not be present and that cases do occur without fever at any time. Vanderhoof (5) has written a very valuable article on pseudomalarial types of pyclitis, i.e., cases of pyclitis which have been diagnosed malaria on account of their intermittent type of fever. Since the use of the cystoscope and the urethral catheter has become general, no case of undetermined infection with purulent urine should go without a most careful examination for the presence of pyclitis. Since I have made it a rule to cystoscope all cases with purulent urine, the diagnosis of pyclitis has practically superseded that of cystitis.

Treatment, in order to be efficient, must follow accurate diagnosis. Formerly there was much difference of opinion as to what was advisable in patients presenting symptoms of cystitis, when the urine was acid it was the usual advice to give some form of alkaline treatment, when it was alkaline the advice was to give acid treatment. We now know that there may be a cystitis with either acid or alkaline urine, and a pyelitis with acid or alkaline urine, and that before anything is done the exact facts must be known. In *colon bacillus infections the urine is practically always acid*, in other infections the urine may or may not be acid; often it is alkaline. The indications are to give some acid forming drug to maintain, if possible, the acidity. The formaldehyde eliminating compounds have given the best service.

Urotropin, 40 to 60 grs daily, has been of great service combined with drinking of large amounts of water, liquid diet, and laxatives as needed. In addition to the general treatment local treatments have given me the very greatest satisfaction, as will be shown in the subsequent case reports. The local treatment has been almost magical in some cases, especially in those patients who had great distress in the bladder or kidney region. It is probable that the mere mechanical opening of the ureter may have done more good than anything else, as the fever often would drop to normal immediately after treatment, as if an abscess had been drained. Argrol had been the drug of choice. From 3 to 5 ccm. of a 10 per cent solution have been injected into the pelvis after cleansing with sterile water. It is somewhat difficult to see how the mere application of any antiseptic solution which is washed away so quickly by the urine could have lasting effect upon the local inflammation, it probably has little or no value. In some cases I have given treatments daily until the trouble was relieved, with apparently good results. Bacterias have been tried, and their value is wholly undetermined. The above treatment combined with rest in bed has given the best results in my practice.

Herewith I am submitting five case reports which show in detail the symptoms, treatment, and conclusions.

CASE 1. Acute pyelitis of left kidney, pregnancy

Personal history. She had been an unusually healthy young woman. She had a baby 18 months old and gave no history of any trouble with her first pregnancy.

Present illness. Six days before I saw her she began to have painful urination at frequent intervals, but got relief shortly after passing the urine, this condition had lasted for two days when she noticed that there was a

more or less continuous pain of slight degree and some soreness present, at every urination the pain was worse, but probably not more acute than at first. About this time she noticed slight pain and soreness in the region of the left kidney, this did not disturb her very much but it gradually grew more painful until she had real suffering with it. Four days after the beginning of frequent urination she had a chilly sensation followed by fever and great pain in the region of the left kidney, from then on she had frequent rigors with high fever following and continuous fever in the intervals. These chills came on irregularly and were nearly always accompanied by attacks of colicky pains in the left kidney and sensations of slight pain along the left ureter. With her physician I saw her on the sixth day of her illness and found in addition to the above history that she was very nervous and in quite a good deal of pain. She had been given morphine in one half grain doses from two to four times daily during the last two days and was easy only when completely under the influence of the drug. These attacks of pain were very suggestive of kidney colic due to stone. The urine contained free pus and many bacilli, it was acid and there was no blood, albumin was present, but no sugar, the specific gravity was 1.024.

Examination. The region of the left kidney was very painful, but no swelling could be detected. The bladder was not involved, neither did the ureteral opening show marked change, the urine from the left kidney contained much pus and many epithelia and bacilli. The right urine was normal. The left urine contained some albumin and a few hyaline casts.

Treatment. The left kidney pelvis was irrigated until the urine came away clear, following the irrigation with sterile water a 12 per cent solution of argrol was injected until a slight sensation of discomfort was noticed. This treatment was given about ten o'clock in the morning of the sixth day of her illness. That afternoon she complained of considerable pain in the region of the left kidney, but nothing like what she had experienced several times daily before the treatment. Morphine was given once during that afternoon the fever did not come up as usual and by the next morning her temperature was normal and remained so thereafter. She felt somewhat sore in the kidney region for about forty eight hours but she never had another attack of pain and received no morphine, except the one dose given immediately following the ureteral catheterization. Her subsequent history is without incident.

Comments. This is a typical case of pyelitis in a pregnant woman. The family physician had correctly diagnosed the condition and called me in to give the treatment locally. The severe attacks of acute pain were due, in all probability to the blocking of the ureter by acute swelling of the mucosa or by pus accumulation in the ureter at one or the other of its normal constrictions. The systemic condition was due to septic absorption and as soon as drainage was established the general condition was relieved and recovery took place rapidly. There was no recurrence of the trouble. As to the value of the local applications I am unable to say. While no cultures were made to determine the nature of the infection it is probable that the colon bacillus was the only organism present. Evidently there must have been some slight involvement of the kidney itself as there was local soreness and swelling which remained for some few days after other conditions were relieved.

CASE 2. Acute pyelitis following acute infectious arthritis.

Previous history. This patient was a healthy young woman until about two years ago when she had a gonorr

rhoeal infection which involved the uterus and tubes and finally ended in bilateral pus-tubes and a collection of pus in Douglas' pouch following an early induced abortion. She was operated upon for this by vaginal incision and evacuation of pus. She had a rather long and tedious recovery, which left her general health very much impaired. She continued her calling, more or less clandestinely, between recrudescences of pelvic inflammation which recurred rather frequently thereafter. During this time she was a patient of mine, but persistently refused to have any radical operative work performed. About two years following the beginning of her trouble she developed an acute multiple arthritis, which was diagnosed acute articular rheumatism, as it bore no resemblance to a gonorrheal arthritis. All the joints became practically well, except the left knee joint, which persisted for some weeks in an acutely swollen condition. During all this time she was carrying a variable rise of temperature with occasional rather high fever, when a new joint would be involved or she would commit some indiscretion in eating. During one of these attacks she began to complain of quite a severe pain in the region of the right kidney. This was accompanied by chilly sensations and rapid and erratic rises of temperature. Practically ever since the inception of her first illness two years ago she suffered from an irritable bladder, but during this last attack of high fever she developed a most distressing dysuria and frequent desire to urinate. These symptoms were not given due consideration, as they had been so common prior to this until the pain in the region of the right kidney became almost unbearable, when examination disclosed a swelling in the right loin, which bulged somewhat forward and was exquisitely tender. The whole mass was movable on respiration and gave every evidence of being an enlarged and tender kidney. The urine which had been examined repeatedly, began to show pus and some albumin, infection of the pelvis of the kidney was suspected.

Examination. By this time she was able to sit up and the joints were not paining her at all but the left knee was slightly swollen. She was brought to my office and examination of the bladder was made. The bladder mucosa was apparently normal except some slight redness of the trigone and marked redness around the urethral orifice. The urethral catheter was passed into the right pelvis and a great gush of pure pus of such consistency as to flow easily through a No. 6 catheter came down and she immediately said that she felt better. The catheter drained away several ounces of pus and the pelvis was most thoroughly irrigated with sterile water.

That day the temperature dropped to normal and she began to improve and the urine cleared rapidly, so that within a week's time she was free from any evidence of trouble, except that there was still quite a good deal of pus in the urine. She was so much improved that she would not permit further local treatment of the kidney pelvis, and three weeks later her urine was normal and so remained. In addition to this one local treatment she was given urotropin freely, and the drinking of large amounts of water was advised. The urine was at all times acid. No examination for the organisms was made, except when examining for pus bacilli were noted present.

Comments. This case shows a marked antecedent history of infection both of the gonococcus and of some undetermined bacillus. It was confined to the right kidney and was relieved almost immediately by draining off the pus which had accumulated in the pelvis of the kidney, after drainage was once established it probably continued without interruption. Undoubtedly the kidney itself was affected also as the drainage did not remove the

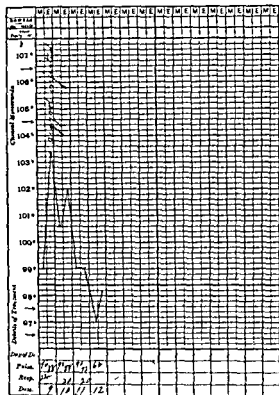
tumor in the kidney region completely, nor did the soreness pass off at once, but as the urine cleared the mass disappeared until when I saw her last several months later, she gave no evidence of ever having had pyelitis. The urine did not contain casts, although I expected to find them present. Had I used any local medication I would have attributed the rapid recovery to its efficacy. It seems highly probable that kinking of the ureter, or mechanical blocking, or the fact that the kidney was freely movable, may have been a factor in the condition, and that as soon as drainage was established the kidney had no trouble in throwing off the infection.

CASE 3. Acute pyelitis, right unilateral, traumatic. Previous history, negative. A strong, healthy German farmer, 52 years old.

Present illness. Two weeks ago he was struck by a bale of hay while getting it out of the loft in his barn, the bale of hay hit him somewhat of a glancing blow over the region of the right kidney in front and on the right side. The blow was of such slight consequence that he paid very little attention to it at the time, but later during the same afternoon he felt some pain and soreness in this region. The night following he complained quite a good deal of his side and had frequent urination. Fever came on next day associated with general aching and soreness. He did not attribute his illness to the injury to his side and, in fact, did not think that the trouble was due to the injury. His physician was called and treated him for several days, giving him remedies usually prescribed for minor ailments. The urine was examined and found full of pus and the diagnosis of pyelitis of the right kidney was made. The usual remedies were given and the progress of the disease was somewhat stayed. The pus in the urine never seemed to diminish, the fever continued from 99° to 101° during the interval between the injury and the time I saw him about ten days later. He had lost very little flesh, but had grown perceptibly weaker. His appetite was about gone and he was losing ground. The tenderness was more marked in the right kidney region than at first.

Examination. This was very satisfactory, as the patient was anxious to get well. He was suffering from very little pain and said that he was improved. The urine was very full of pus, the region of the right kidney was swollen, was very tender, and the overlying muscles were tense. A roundish mass, giving the impression of the kidney being greatly enlarged, was occupying the right kidney region. Examination elsewhere was negative. There was no tenderness over the bladder, and urination was somewhat less frequent than at first. He had a temperature of 100.5° and a pulse of 94. Urination had not troubled him greatly, although it was more frequent than normal. He was advised to go to the hospital for a complete examination, which he did the next day. The bladder was found to be normal, the ureters were normal also. The catheterized urines from each kidney showed the following: The right urine was loaded with pus, there was some albumin but no casts; it was acid. The left kidney urine showed many epithelial cells but no pus, blood, or casts, and no albumin. On entrance the temperature was 99°, pulse 96, next morning, i. e., the day of the examination, the readings were temperature 99.3° pulse 86. The diagnosis of right acute pyelitis, probably due to local injury ten days previously was made.

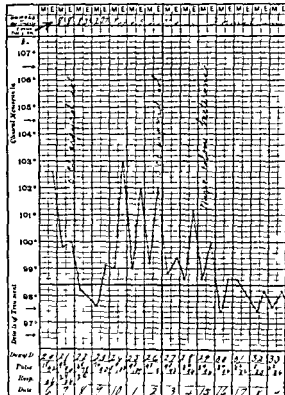
Treatment. At the time of the urethral catheterization the right kidney pelvis was irrigated with sterile solution and then treated with 5 ccm. of a 10 per cent argyrol solution. Urotropin in 15 grain doses, was given four times daily, water in large amounts was ordered. The afternoon of the catheterization the temperature rose to 103.4°, but the pulse was only 88. He did not suffer from



Fever chart of Case 3, showing the rapid decline of the fever after the local treatment by drainage and application of argyrol solution

the examination. Next day the temperature went to 102° and then fell to normal and remained there. He went home feeling well on the afternoon of the twelfth day and has been well since. The urine still had pus in it, but the soreness and pain have become very much less. Subsequent reports show that his recovery was rapid and satisfactory. Exploration of the kidney was advised in case the local treatments were not curative.

Comments. This is very clearly a case of acute pyelitis caused by injury to the kidney itself which lowered the resistance and permitted organisms to set up an inflammation. Although the injury was so grave as to be noticed at the time it was received, the patient himself did not attach any importance to it as a cause of his illness. He became sick the night following the afternoon of the injury with soreness all over, general aching, and the other ordinary symptoms of mild influenza and some bladder irritability. Had it not been for this irritability of the bladder the correct diagnosis by the family physician would not have been made. Cystoscopic examination showed a normal bladder and normal ureteral openings. The pus was under considerable tension and flowed from the catheter readily in a small stream, so it is very probable that the relief of tension and the opening of the ureter with the catheter were the main factors in the rapid recovery rather than the effect of the drugs which were given. The soreness subsided within a few days and the temperature remained normal.



Fever chart of Case 4 showing the rapid fall of the fever after local treatment with irrigation and application of argyrol solution, then the second rise of fever, followed by another treatment with rapid fall of temperature and relief of symptoms. The fever remained normal thereafter, but bladder irritability returned, as shown by the history, but further local treatments gave relief.

CASE 4 Acute pyelitis bilateral mixed infection

Previous history. Female, 43 years old, mother of twelve children, has no pathological history bearing upon the present illness in any way.

Present illness. Without any previous disease of the genito-urinary organs she began to have frequent urination attended with very little bladder irritation for several days, after about four days she began to have a sensation of pain and soreness in the bladder region, especially noticeable following the act of urination. Fever now developed rising during the afternoons to as high as 104°, accompanied by a chilly sensation when the fever was at the highest. While the range of the fever was irregular it was continuous and associated with an almost constant headache of variable severity, which at times required doses of aspirin to give relief. There was general aching and soreness all over the body, but the bladder symptoms were the most prominent and gave her the most concern. This condition lasted for about ten days when I was called in consultation.

Examination. She was pale but otherwise apparently well nourished, the temperature was 101°, the pulse 88. She complained very little and said that her bladder was much better than it had been previously but that she had

headache, occasional chilly sensations, and frequent urination, which was often slightly painful at the end of the act and for a short while afterward. Her bowels had moved regularly from medicines, her appetite was gone, and she felt sick. The abdomen was considerably distended, but not sore except by pressure directly over the bladder and in the upper part of the abdomen along the right rib margin. Palpation elicited soreness over the right loin behind and over the region from the gall bladder in front to the kidney region along the rib margin. The region of the gall bladder was tender on deep pressure, the region of the kidney in front was tender to pressure, and here a small mass could be felt which gave pain when pressed and was thought to be the right kidney. Her physician had frequently examined the urine, which from the beginning was found to contain pus and albumin and many bacilli but neither in marked quantity. The diagnosis of acute pyelitis was made and acid diuretics were ordered, with instructions to drink large amounts of water daily. Owing to the continuous high fever, tests were made for typhoid fever, tuberculosis, and malaria, which were found negative.

Her condition not improving, she was brought to the hospital December 6, almost three weeks from the beginning of the illness. The urine was neutral, rose pale, showed a slight sediment, contained albumin, no sugar, no red cells, no casts, but it contained bacilli, many pus-cells, amorphous urates, and epithelia. The reaction of the urine was neutral owing to sodium bicarbonate being given. The blood examination gave a leucocytosis of 10,000 total with 60 per cent polymorphs.

She was cystoscoped December 7th. Catheters were passed into both ureters and separate studies made of both urines as follows: Right urine was cloudy, neutral, had large amount of pus, left urine was neutral, clear, had small amount of pus. Both urines contained a small amount of albumin and no red blood-cells. A bacteriological examination showed colon bacilli in large numbers and some staphylococci in the right urine, but nothing in the left.

Treatment. The right kidney pelvis was injected with 5 ccm. of a ten per cent solution of argyrol at the time of examination, the left was not injected because it was thought to be free from infection. Following the examination of the urine she was reexamined and both kidney pelvis were injected with argyrol. Uterine and hysterosalpingus were given and the drinking of large quantities of water was advised. As she complained of headache and cold feet practically all the time, ice-bags to the head and hot bags to the feet were used almost all of the time. A liquid diet was given every three hours. Immediately following the local treatment on the 7th, the fever dropped and the general symptoms abated very much, but on the afternoon of the 8th the fever and general discomfort returned, so on the 12th she was again catheterized and the pelvis of both kidneys were re-injected with argyrol solution. The temperature again dropped and she felt much relieved. The temperature came up again during the afternoon of the 14th, but it went down without further local treatment and remained normal for about two weeks, when her physician phoned that she was beginning to have a return of her trouble. During the treatment while in the hospital, she was given 5 grain doses of aspirin when headaches were severe, this was given only occasionally. Also, Sherman's mixed colon bacterins were given once during her stay in the hospital.

She went home on December 20th, and remained free from trouble until about January 10th, when she began to have slight irritation of the bladder following urination.

Within a few days slight afternoon rise of temperature was noticed, rising up to 100° by the 13th, when she returned for further local treatment. In the hospital the temperature was normal, the urine contained no pus, but some epithelial cells and acid, no casts or blood and no bacilli. Both kidneys were treated and she regained her normal feelings. The same treatment was given on the 16th, when every examination gave normal results in the urine. She has been given colon mixed bacterins regularly twice a week since first leaving the hospital. She was relieved of the bladder irritation after the second local treatment and has had no symptom of it since.

Later report. Since the above notes were written, she has been back to the hospital for re-examination on account of some slight bladder irritability. Both urines were found to be normal and free from coliform infection. There is no soreness or tenderness in the kidney region.

Comments. This patient was thought to have had a mild typhoid or malarial infection at the beginning of her ailment. The possibility of an acute tuberculosis was strongly suspected, even influenza was discussed, as this disease was then prevalent. Tests were made to determine the causative agent, but all were found negative. From a study of the separate urines the correct diagnosis was easily made and the appropriate treatment given. The colon bacillus associated with the staphylococcus, was the infective agent and the entire process seemed to be limited to an infection of the pelvis of the kidneys. The duration of the attack was somewhat prolonged, but it yielded satisfactorily to local and general treatment. Without a careful examination of the urine, which suggested cystoscopy and ureteral catheterization, the true cause of her ailment would not have been diagnosed.

Case 5. Acute pyelitis of both kidneys.

Personal history. This patient has not been well during the past few months, although she appears to be robust, during the past three years she has suffered quite a good deal from backache low down in the spine. Almost all of last summer she suffered from pain in the left limb. She consulted a physician, who told her that this pain was due to some womb complaint, and she was treated locally for it. The periods have been normal except that about five months ago she had a dark colored discharge which lasted for only a few days and then passed off without hot douches. She had had mild leucorrhoea for three years, but local treatments for this relieved her last summer. She is the mother of two children, the youngest is four years old. There is no history of any other pregnancy.

Present illness. On January 24, 1915, she noticed a soreness in the pelvis and a disagreeable sensation in the region of the bladder associated with frequent painless urination following urination she would have a bearing down sensation with throbbing in the bladder during the night she passed urine very often which disturbed her sleep greatly during the day she would pass urine often, but not so frequently as during the night. Three days later she began to have night pain in the region of both kidneys, but much more on the right side. Soreness gradually developed in this region and extended down towards the pelvis. On January 30 (Sunday) she began to have aching sensations all over the body with onset of fever and frequent slight chilly sensations at various intervals. On January 31 (Monday) she was confined to bed and called Dr. Harrington who prescribed for her. He examined the pelvic organs and could not find sufficient cause there for her trouble. The urine was examined and some macroscopic pus was found, also albumin. At this time she did not complain so much of the bladder trouble as at first, but she did of the chills and fever, from 100° to 104° following the chills, which came on at irregular

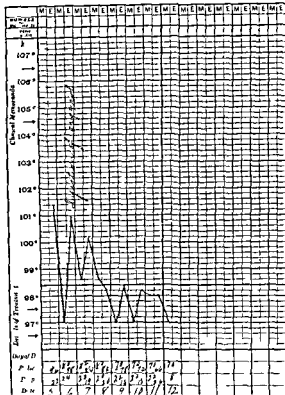
intervals of from six to eight hours. Vomiting followed the chills quite often, she was constipated, she was sore all over the pelvis in front and complained of an aching sensation over the kidney regions.

This condition persisted until I was called to see her with the family physician on Thursday. I found her as above described. The bladder symptoms had somewhat abated, but there was more soreness over the right kidney than previously noticed, on palpation I could detect a movable and enlarged kidney, which was tender on the right, but on the left palpation was negative. While there was tenderness over the pelvis, examination did not show any trouble to explain her feelings.

Diagnosis. Taking into consideration the history and the physical examination, the diagnosis of acute pyelitis was made. It was recommended that she be sent to Providence Sanitarium for examination and treatment.

Treatment. On Friday, February 5, she went to the hospital and on the next morning was cystoscoped and both ureters were catheterized. The bladder was normal, the urine from the left kidney was apparently normal, but examination showed the presence of pus and bacilli, the right urine was quite cloudy with small floculi, which were flakes of pus with many bacilli. Cultures gave positive colon bacilli in pure culture in both urines, a few hyaline casts and some blood cells were found. The right pelvis was injected with 5 ccm. 10 per cent argyrol solution the left was not injected, as it was thought to be normal at the time of the examination. Fever, on entrance, was 101.4°, pulse 106. The temperature dropped to normal by the next morning, the next afternoon it was up to 100.4°, it went down to normal every morning with a slight rise in the afternoon until the 7th—two days after treatment—when it remained normal thereafter. On the 7th she was given a dose of 50,000,000 colon bacilli. No other treatment was given. The soreness and pain passed off coincident with the fever. She looks perfectly normal. All other symptoms have subsided. She went home on the 12th, since then she has been well the urine is normal.

Comment. This patient has been in good health for several months and with no antecedent history which might suggest a possible causal relationship, she gives no history of any recent vaginal or uterine trouble which might be a factor in this illness. Without any previous symptoms of bladder ailment, she began to have frequent micturition together with a feeling of soreness in the pelvis and the bladder, however following the act of micturition she did have some discomfort as manifested by throbbing and a sense of bearing down in the region of the bladder. This continued for two days before fever set up, this was soon followed by chills and other evidences of infection. At the same time she began to notice some aching in the region of both kidneys, but the aching was more noticeable in the region of the right kidney. The symptoms were so similar to those of some local trouble in the region of the bladder or the pelvis or both regions that the physician examined her for this trouble, but he found nothing in these regions to suggest the cause of the frequent micturition and the cause of the systemic infection as evidenced by chills and fever. When the urine was examined microscopically pus was found which gave the first positive evidence of the location of the real condition behind these various phenomena of frequent and now painful micturition, fever, chills, and general aching. A rather peculiar thing now came about that is the symptom of painful micturition subsided without any apparent reason, although the fever and other general symptoms were more marked. This has been observed before in other patients and I do not know how to explain it, it may be due to



Fever chart of Case 5, showing the effect of local treatment. Only one was given but the effect was satisfactory. Neither temperature nor bladder irritability returned.

passing off of the bladder reflex, which is often the first symptom of a kidney involvement.

The diagnosis of acute pyelitis was confirmed by cystoscopic examination and a study of the separate urines. The local treatment of the pelvis of the kidney with argyrol solution gave relief and we feel rather sure that the bacteria were of a certain value. It seems that one can say with some assurance of being correct that the symptomatology of acute inflammations of the kidney pelvis is not correctly interpreted by most physicians, but that since the use of the ureteral catheter has become more general, so much more is being learned about these cases that the diagnosis is becoming relatively easy and accurate.

While the literature of acute pyelitis reports cases without a rise of temperature, yet the cases which I have reported all showed fever at some time during the ailment. I am inclined to the belief that all patients with acute pyelitis have had fever at some time during the course of the disease and that to find a patient without fever at the time of the examination does not prove conclusively that the entire duration of the disease was afebrile.

It is not an uncommon occurrence to see pa-

tients suffering from acute pyelitis which has been diagnosed malaria (especially in the South), typhoid fever, colitis, infected kidney from stone, etc., but more often, probably, has a mistake been made in the diagnosis of low grade fevers following childbirth as puerperal fever when it was pyelitis. There are some few cases which run the entire course without any localizing symptoms referable to the kidney, and unless the urine be carefully examined the correct diagnosis will not be made, then, again, many cases are diagnosed cystitis because all of the symptoms are located in the bladder. In these cases a cystoscopic examination with catheterization of the ureters is an absolute necessity to determine the nature of the disease.

In the great majority of the patients treatment as outlined above is rapidly efficient and easily carried out with very little discomfort to the patient. As to the value of vaccines I am undecided, as those patients who did not get them seemed to do as well as those who did.

Résumé Pyelitis is a disease which is very frequently not diagnosed, due to the fact that the symptoms are so often directed to the bladder. There may be no localizing symptoms at all to guide one, unless the urine be microscopically examined, followed by cystoscopy and ureteral catheterization, it is possible to overlook the disease. Tenderness and pain in the kidney may or may not be present, depending upon whether or not there is blocking of the urinary

outflow or upon involvement of the kidney substance.

Treatment should be general and local; general treatment should be to secure an acid urine with some drug which will eliminate formaldehyde; also, massive water drinking must be ordered, especially in those patients who have no nephritis; liquid diet is best; rest in bed, and fast, and by all means advisable, kidney drainage by the ureteral catheter and local applications.

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POSITION OF STABILITY IN THE TREATMENT OF FRACTURES

By E. B. CLAYBROOK, M.D., F.A.C.S., CLUMBERLAND, MARYLAND

IN spite of the tremendous amount of literature that has appeared in the past six years upon the treatment of fracture, and in spite of the arguments pro and con as to the necessity and indications for direct fixation as against the closed method, the writers have all failed to tell us how to reduce a fracture and to know that it is satisfactorily reduced by the closed method. The articles have all been strong on the diagnosis of fracture, and have elaborated dozens of different ways of applying splints to keep fractures in place, but all the methods or most of them are evidently failures in the hands of the man "on the firing line," or this constant and persistent demand for direct fixation could not live. Now why is this?

There has been so far no definite rule laid down, even by those who argue strongest for direct fixation, as to which fractures should be opened and which not. It seems to rest more with the personal fancy of the man into whose hands the case falls than with anything else, some, as Mr. Lane, claiming that all should be treated by direct fixation, and others that none should be so treated.

Now it seems to me that it is easy enough to make a fairly good working rule, based upon the conditions present in the given case as it comes to be treated. And such a rule based upon the pathological conditions should appeal to the unbiased mind as worthy of consideration and adoption. What we have to say in this paper

refers particularly to fractures of the long bones, but has some bearing upon all fractures.

In the past, most fractures were set about as follows: The limb was pulled straight and the ends manipulated, and when the ends seemed in good position, the limb was put up "in extension," in the hope that the ends were in good position, and that a good result would be obtained. How futile was this hope in many cases has been proved by the fact that of all the malpractice suits instituted in one year in this country 57 per cent were for poor results in fracture cases.

No fracture should be put up in fixation until we have assured ourselves that we have apposition. This can be done in all cases by testing to see if we have what I have termed a "position of stability." I have used this term because it seems to me best to express the idea and the conditions present. When we set a fracture, the patient should have a general anæsthetic, both for the relief of pain and for the relaxation of muscular spasm, but chiefly for the latter. Then the limb should be extended until the ends can be brought into apposition, and, after manipulating them until this seems to be accomplished, the traction should be gently relaxed, the limb being carefully supported. If there is no slipping by of the ends, the lower fragment should be gently pressed toward the body, and, if no slipping occurs, the pressure should be increased to a considerable extent until we are assured that there is no slipping and that the serrations of the fractured ends are engaged and slightly impacted.

If we can get a secure position of stability — it makes no difference how we put up the fracture, provided that we maintain the alignment and prevent axial rotation—we can rest assured that we will get a good result. In the section on fractures in Bryant and Buck's *American Practice of Surgery*, Eve says: "A retention apparatus should be sufficiently tight and unyielding to prevent deep movement of the fragments."

This is a fallacy, and is a dangerous doctrine to appear where it does, because if the serrated ends of the broken bones are not engaged, no apparatus on earth can be put on "sufficiently tight and unyielding to prevent deep movement of the fractured ends" with safety to the part and to the patient. A splint should never be put on with this end in view. This is the very reason that the plaster cast is looked upon with suspicion. Casts have been applied to prevent deep movement of the fracture ends with, at times, disastrous results.

The position of stability is the keynote in the

successful treatment of fractures, and strangely enough it has never been emphasized, although those who have argued so ably and eloquently for the promiscuous open fixation have been always striving for this end only — a position of stability. That is all that plates, pegs, nails, wire, inlays, and what-not can give us. So why not get down to basic facts? If we can get a position of stability with the fracture closed, we should by all means put it in fixation without resort to operation. The form of fixation is immaterial, provided it meets the two essential requirements of maintaining alignment and preventing axial rotation. I believe that each man should use the form of fixation that he feels he can handle best, but that plaster is far the best and safest if well applied by one who knows how. It always fits, is cheap, easy to get, and is the most comfortable of all dressings if properly applied. But its proper application is an art in itself, and must be learned just as surely as any other procedure in surgery.

It is astonishing how many fractures one sees put up in fixation that does not fix. It seems that many men are slow to learn that no fracture of a long bone, unless close to a joint, can be successfully treated unless the fixation extends to, and includes, the joints next above and below the site of fracture.

It stands to reason that if the theory of a position of stability is correct, that any treatment by constant traction is incorrect as a routine. I believe that Buck's extension has been responsible for nearly as many permanent cripples as has tuberculosis of the hip-joint. The idea of extension is that it will maintain the length of the limb until healing takes place. We all know that it does not. To quote Eve again: "In all fractures of the middle and upper third of the femur, shortening is inevitable, and if it does not exceed one inch, the treatment should be regarded as satisfactory." Following this he extols Buck's extension as the best means of treatment. The other and newer methods of extension cannot possibly produce different results, but they may possibly achieve the same bad results with less pain and discomfort to the patient.

The bone itself is the best thing to maintain the length of the limb, and even if the bone has been broken, if we get the ends together, and keep them together, the limb is not going to be shortened. If we get a good position of stability, the exaggerated muscle tone, or muscle spasm, is our best ally in maintaining this position of stability, so why should we kill off this ally at the beginning of the fight? If we cannot, after repeated

attempts, secure a position of stability, it means that the ends are so oblique, or are of such a shape, that they will not engage and hold together, or that soft parts are interposed and keep the ends from engaging. When we know that this is so, reason demands that we open the limb and get a position of stability by direct fixation, with plate or some other device, if we expect to get a good result, and we should regard that as the only proper treatment. But we should always bear in mind that direct fixation is never an emergency operation, never to be lightly undertaken, and never to be attempted, except by the specially trained in surgery, and in such surroundings as will insure absolute surgical asepsis. We should also remember that, for some reason, bones unite slower after open than after closed reposition. All the authorities seem to agree that the primary

clot has no part in the formation of callus, or the regeneration of the bone, but I do not believe it. I believe that it is a most important primary preliminary step, and that when we destroy it, or it fails to be present, as in compound fractures, the delay in union results, not from a mild infection as claimed, but from lack of the primary clot.

If we establish a rule of this kind and work faithfully to get results, we will find that the more experience one has in this work the greater will be the percentage of cases in which a position of stability can be secured, and consequently fewer and fewer will need open fixation. The open method should not claim more than from 5 to 10 per cent in good hands. But when there is no chance of getting a position of stability, no other procedure should be considered, and the indications for open operation are plain.

AN IMPROVED GASTROSTOMY

By MILTON R. HOOKMAN, M.D., F.A.C.S., NEW YORK

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IT occurred to the writer that if the purse-string sutures placed about the tube, Lambert fashion, in a Stamm-Kader gastrostomy, were inserted in an eccentric manner instead of con-

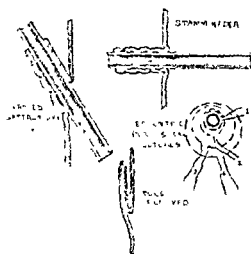
centric, the cone within the stomach thus placed parallel to the anterior wall would act as a valve to prevent the regurgitation of food through this new gastric nistula.

In a recent case of inoperable mediastinal tumor (extra esophageal), in the service of Dr. Parker Hays, to whom I am indebted for operating, this procedure was carried out with most gratifying results. A circular purse-string deep Lambert of Pagenstecher linen was placed well up near the lesser curvature, the stomach opened, tube inserted, and the suture tied. The next suture was begun at least a half inch below the tube and carried around in a circular manner so as to pass less than a quarter inch above the tube, then passed around to where the suture began and there tied. This pointed the tube within the stomach upward, two more sutures were placed in a like manner, the tube fastened to the stomach and abdominal wall, and the wound closed.

As more of the gastric wall was utilized below than above, the lower part acted as a spring and forced the apex of the cone close to the anterior wall of the stomach, and the channel, being entirely within the stomach and movable, created a distinct valvular action.

This technique may be utilized in making a jejunostomy or cecostomy, the apex of the cone always pointing in an aboral direction.

centric, the cone-like nipple in the interior of the stomach would be produced in addition to the long channel in an upward direction, as in a



A NON-LEAKABLE TROCAR

BY C. JEFF MILLER, M.D., F.A.C.S., NEW ORLEANS

IT has seemed impossible to devise a trocar that would not allow a certain amount of leakage around the instrument as the fluid was withdrawn. Some time ago I had occasion to discuss the mechanical defects of several instruments in daily use by the surgeon, with Dr. C. Edmund Kells, of New Orleans, a dentist of national reputation and an inventor of numerous mechanical and electrical devices well known to the mechanical world. Among the instruments mentioned was the trocar. He became interested in the subject and soon after

The accompanying illustration and description of the trocar were furnished by Dr. Kells, who will be pleased to give further details to anyone sufficiently interested to write to him.

"This trocar carries a double sliding and telescoping sheath, the outer end of which is bell-shaped, while the barrel of the trocar is perforated at stated places. The trocar blade is drilled and is carried at the end of a hollow tube, which in turn has an aperture.

"To use, connect the rubber tubing from the aspirating machine to the outlet of the trocar



Non leakable trocar used in emptying cysts, pus accumulations, etc

presented me with the instrument described below. I have used it in emptying cysts, pus accumulations, and especially in distended gall-bladders, and found it so satisfactory that I desire to recommend it to the profession.

It is a simple device, easily cleaned, and can be made in any desired size. It must be used, however, in conjunction with a suction apparatus which may be attached to the ordinary hydrant, but preferably with an electric driven motor attachment, also devised by Dr. Kells and now in use in most of the hospitals in New Orleans. This suction apparatus, with various easily adjusted tips, may be used for emptying cavities, removing fluids from the abdominal cavity, or cleansing bleeding areas, and has the advantage of automatic irrigation, if desired.

and start the pump. Then, with the trocar withdrawn into the barrel, place the end of the barrel at the point to be punctured. Press the bell of the sheath firmly against the part, hold all firmly, and push the trocar blade down as far as it will go. "By holding the sheath firmly, the barrel can be pushed in to any desired depth, then the trocar blade is rapidly withdrawn its full length, and the contents of the sac are quickly withdrawn by the aspirating device.

"Any fluid that may leak out around the barrel of the trocar is at once sucked into the bell-ended sheath and carried out with the rest of the fluid.

"Trocar blades of any desired shape or aspirating needles of any size or length may be used interchangeably in this device."

CORRESPONDENCE

DIAGNOSIS OF EARLY PREGNANCY

To the Editor: A sign of early pregnancy has been described by Labhardt in the *Zentralblatt für Gynäkologie*, 1914, xxxviii, 1017. He described as an original contribution the discovery of a sign of pregnancy occurring as early as the fourth or fifth week, even before, of a livid discoloration of the

I have no wish to cause a discussion over the priority of the discovery of this sign, but I believe that it was discovered by a Frenchman named Jacquemin, and was described in a textbook by Parent Duchatelet, which was translated into German by von Becker in 1837. Kluge, Professor of Midwifery at Berlin, also described this sign after Jacquemin.

In "A Study of One Hundred Cases of Early Pregnancy," I described Jacquemin's sign and drew attention to the spot below the urethra which was first congested, as follows: "In this series of cases, it was found that this hypertrophy of the vessels and venous congestion of the vagina occurred first at a spot upon the anterior vaginal wall about 2 cm below the orifice of the urethra. This spot later enlarged to spread the violet hue over all the vagina. This spot, called by the author 'Jacquemin's spot' (Fig. 1), did not at first show upon the surface of the mucous membrane, as the mucous membrane here has creases and crevices, the sign was seen as streaks of livid, bluish purple at the bottom of these furrows. The phenomenon may best be seen at its first appearance by separating the labia and stretching the mucous membrane of the anterior wall, so that these creases may be opened and the engorged veins exposed. As will be seen from the table, the sign was observed in 57 per cent of the 100 cases before the thirteenth week. In 43 per cent it was absent. It was absent in the very early weeks of pregnancy, present slightly from the seventh to the tenth week, and commonly after the tenth week. As pregnancy advances it is present in a greater proportion of cases, and after the thirteenth week it is a very reliable sign."

This sign was also described in my book entitled *Studies in Gynecology and Obstetrics*.

My article was accompanied by numerous illustrations, the first of which accompanies this letter, and shows the point described by Labhardt and which I wished to give credit where credit is due, named 'Jacquemin's spot.' My article was widely reviewed and was written to describe another sign of pregnancy which I believed to be really new and original with me.

ELLICE McDONALD

New York

Am J Obst 1908 lvi

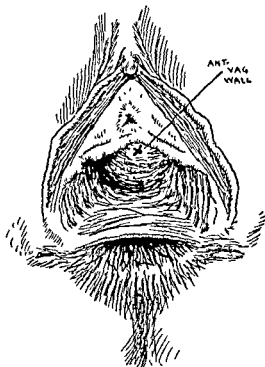


Fig. 1 Jacquemin's spot

vagina. It consisted of the presence of a band, livid in color, running from one lesser labium to the other in the region just below the urethral opening. He believed that it was due to the congestion of the numerous small vessels running between the bulbs of the vestibule on either side. These vessels lie directly beneath the mucous membrane and are the first to show the congestion.

Clinical Congress of Surgeons of North America

SIXTH ANNUAL SESSION

BOSTON

OCTOBER 25 TO 29, 1915

CLINICAL CONGRESS OF SURGEONS OF NORTH AMERICA

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THE HOSPITALS AND MEDICAL SCHOOLS OF BOSTON

II BOSTON UNIVERSITY SCHOOL OF MEDICINE

BY HORACE PACKARD, M.D. I.A.C.S., BOSTON

Boston University School of Medicine was founded in 1873 as a part of the newly established Boston University, the opening exercises being held on November 5th of that year. Its aim has been, to give its students a broad and sound training in the fundamental sciences of medicine, to make useful, practical, liberal, and successful physicians, true healers of the sick, to impart a working knowledge of modern surgery, obstetrics, and the specialties, to uphold high standards of medical education, to inculcate lofty ideals of ethics and morals.

From its inception its doors have been open to students of both sexes on uniform terms and conditions. The school has made a special feature of giving its students thorough training in the principles and practice of homœopathy.

At its inauguration, entrance examinations were required of all applicants who were not college graduates, which at that time was a marked innovation. So far as is known, it was the first

medical school in the country to offer a graded course of three years (1873), and it was one of the first to make such a course compulsory (1877). It was the first medical school in this country to offer a four years' course (1878), also the first to make the four years' course compulsory (1890), while in 1907 an optional five years' graded course was instituted, in which it was also first. The annual sessions were lengthened to eight months each in 1878, and courses leading to the degrees of Bachelor of Medicine and Bachelor of Surgery were offered. Twenty years later, in conjunction with the College of Liberal Arts of the Boston University, a six years' course made its graduates eligible to the degrees of Bachelor of Science and Doctor of Medicine, while now, under specific conditions, the degree of Doctor of Philosophy is conferred by the Graduate School of Boston University.

The chief features of the five years' course which the school first offered in 1907 are briefly



Robert Dawson Evans Memorial Research Building

outlined as follows. During the first four years study is confined to the regular four-year curriculum. In the fifth year a minimum of 500 hours in special laboratory or clinical work is required, under the direction of the executive committee. Eight months' service as an interne in a hospital of at least fifty beds will be accepted in lieu of 300 hours' work, or twelve months' service in lieu of 400 hours. At the completion of the first four years, the degree of Bachelor of Medicine or Bachelor of Surgery is conferred upon duly qualified students, and those who satisfactorily fill the requirements at the end of the fifth year receive the degree of Doctor of Medicine *cum laude*.

By the cooperation of the College of Liberal Arts and the School of Medicine, in 1908 Boston University offered a combination course whereby the two degrees Bachelor of Science and Doctor of Medicine may be acquired in six years of study. The essential feature of this course is the recognition of the cultural and practical value

of such independent sciences as anatomy, embryology, histology, physiology, bacteriology, medical chemistry, and pathology, sciences which are acknowledged as the fundamentals of medicine. Two years in the College of Liberal Arts, including full courses in physics, biology, chemistry and modern languages, plus two years devoted to the fundamental medical sciences in the Medical School are required to obtain the Bachelor of Science degree. An additional two years in the Medical School completes the course and furnishes the required four years for the conferring of the degree of Doctor of Medicine.

CLINICAL FACILITIES

At the present time no medical school that lacks hospital wards and clinics is equipped for work, and Boston University School of Medicine is especially fortunate in possessing the closest affiliation possible, excepting organic union, with a large hospital, the Massachusetts Homeopathic Hospital. The facilities afforded by this institu-



Boston University School of Medicine

tion are evidenced by the annual report for the year 1914, which shows that during the year 23,260 patients were treated in the various departments of the Hospital. In the wards of the main hospital 6,533 patients received treatment, of these, over 3,500 were in the surgical wards, and over 1,000 in the obstetrical wards. At the Haynes Memorial for Contagious Diseases 838 cases were treated. In the out-patient department 12,188 new patients were treated, and over 1,100 major and 2,000 minor surgical operations were performed. The hospital includes medical, surgical, and maternity wards, wards for special work on the eye, ear, nose, and throat, special children's department, out patient department, contagious hospital, and the Robert Dawson Evans Department for Clinical Research. A new maternity capable of accommodating upwards of 1,200 cases annually is nearing completion. In addition, clinical facilities of great value are offered by the Cullis Home for Consumptives and the Westboro Insane Hospital, where the state cares for a daily population of over 1,200 patients in all the various forms of mental aberration. Thus the abundant clinical

facilities of the school furnish the instructing staff and the students practically an *embarras de richesse*.

CLINICAL TEACHING

In keeping with the spirit of the age, the school has to a large extent substituted clinical teaching, conferences, recitations, and quizzes for the didactic lecture courses. The latest plan has been to devote the morning hours, 9 00 to 1 00, throughout the senior year to clinical work, to divide the class into small sections, to allow each student personally to assist in surgical operations, to assign students in small groups to a five weeks' service at the State Hospital for the Insane at Westboro, and to a five weeks' forenoon service at the Contagious Hospital, the remainder of the year being divided among medical, surgical, and obstetrical clinics, and the specialties. Such an arrangement brings senior students into the most intimate contact with actual medical and surgical work and gives opportunity to acquire a technique impossible to obtain in any ordinary lecture course.

The first faculty of the school comprised a list of twenty six professors and instructors. Today



At left, Robert Dawson Evans Memorial Research Building Left center, Boston University School of Medicine At right, Massachusetts Homeopathic Hospital

the entire faculty includes a list of seventy-three, a number large enough to utilize effectively the facilities at the disposal of the school

POST-GRADUATE COURSES

Since 1910 the school has offered post graduate courses which run about six weeks. Fourteen such courses are at the present time available, covering medicine (homœopathy), surgery, pathology, and the specialties. These courses are adapted to the needs of the general practitioner, but opportunities for pursuing special investigations along selected lines, pathological and clinical, can usually be arranged for

MEDALS AWARDED FOR SCIENTIFIC EXHIBITS

Two gold medals have been awarded the Boston University School of Medicine for demonstrations of the originality and special excellence of the work done in its pathological and physiological laboratories. The first, at the Louisiana Pur-

chase Exposition held in St. Louis in 1904, on an exhibit which included, among other things, photographs of students performing experiments in the Physiological Laboratory, with chest pantographic, sphygmographic, cardiographic, and other tracings, done by the students under the instruction of Professor A. W. Weyssse, and a series of anatomical and pathological specimens prepared and mounted by the gelatine process perfected by Dr. W. H. Watters, Professor of Pathology and Curator of the Museum. The second medal was awarded at the Lewis and Clark Exposition held in Portland, Oregon, in 1905, also for evidences of work done in its physiological and pathological laboratories.

The latest award made to Boston University School of Medicine is that of a silver medal, bestowed as a second prize at the International Tuberculosis Congress, held in Washington, D. C., October, 1908. The exhibit shown by the school consisted of specially prepared pathological specimens which demonstrated various lesions of tuberculosis in the tissues and organs of the body. After the Congress the exhibit was borrowed by the state and included in the educational exhibit held under the auspices of the State Board of Health in the city of New York during the winter months of 1909, during which period it was visited and inspected by about three quarters of a million of people. Later it was loaned to the Tuberculosis Exhibit of Philadelphia and was still further used for educational purposes. The widespread influence of such an exhibit cannot easily be estimated, and its power to win such recognition as a silver medal in open international competition testifies eloquently to its merits.



Haynes Memorial Buildings for Contagious Diseases

PRELIMINARY CLINICAL PROGRAM FOR BOSTON MEETING

MASSACHUSETTS GENERAL HOSPITAL

Monday

- C. A. PORTER—9 Operations Gout. Cancer of stomach.
 D. I. JONES—9 Operations Cancer of rectum (first stage)
 R. C. CABOT, HUGH CABOT, and OSCAR RICHARDSON—10 Demonstration Comparison of clinical evidence with postmortem findings.
 HUGH CABOT et al—7 Operations Epididymectomy for tuberculosis. Litholapaxy for stone in bladder Ureterotomy for stone
 C. L. SCUDDER—3 Demonstration Fractures.
 HUGH WILLIAMS—3 Demonstration Cases

Tuesday

- E. G. BRACKETT and R. B. OSGOOD—9. Operations Excision of knee with bone plates Exploration of knee joint through median incision.
 D. L. EDSALL—10 Clinic
 C. L. SCUDDER and H. F. HEWES—10 Demonstration Diagnosis and treatment of chronic gastric ulcer
 G. W. W. BREWSTER—2 Operations Hysterectomy for fibroids. Appendectomy
 LINCOLN DAVIS—2 Operations Ureterotomy for stone Hysterectomy
 ROGER J. LEE and BETH VINCENT—2 Demonstration Splenectomy for pernicious anemia
 C. C. SIMMONS—3 Demonstration Osteomyelitis
 G. A. LELAND, JR—3 Demonstration Anthrax

Wednesday

- F. G. BALCH—9 Operations Prostatectomy Abdominal tumor
 R. B. GREENOUGH—9 Operations Benign tumor of breast Cancer of breast.
 Z. B. ADAMS, H. A. DANFORTH and C. H. BUCHOLZ—10 Demonstration Sclerosis.
 L. T. BROWN—10 Demonstration Postural defects
 FARRAR COBB—2 Operations Hysterectomy for cancer (Wertheim)
 HUGH WILLIAMS—2 Operations Gall bladder
 R. C. CABOT, HUGH CABOT, and OSCAR RICHARDSON—7 Demonstration Comparison of clinical evidence with postmortem findings

Thursday

- HUGH CABOT et al—9 Operations Nephrectomy for tuberculosis. Pyelotomy for stone. Prostatectomy
 R. C. CABOT—10 Clinic.
 ABNER POST—10. Demonstration Congenital syphilis
 E. G. BRACKETT and R. B. OSGOOD—2 Operations Open operation on hip Gig saw osteotomy of knee joint
 C. A. PORTER, A. K. STONE, H. F. HEWES, and J. B. HARTWELL—3 Demonstration Tuberculous cervical adenitis
 W. J. MIXER—3 Demonstration Fracture of the skull.

Friday

- C. L. SCUDDER—9 Operations Duodenal ulcer. Cancer of stomach. Fracture of femur
 R. B. GREENOUGH—9. Operations Cancer of jaw, tongue or lip
 J. C. WARREN—10 Demonstrations Reminiscences of the discovery of ether
 C. A. PORTER—10 Demonstration Cases
 R. H. MILLER—10 Demonstration Tetanus
 C. A. PORTER—2 Operations Tuberculous cervical adenitis Operation on peripheral nerve
 D. F. JONES—2 Operations Cancer of rectum (second stage)

Surgical Specialties

- A. COOLIDGE, J. P. CLARK, H. P. MOSHER, D. C. GRELNE, W. T. KNOWLES, H. A. BARNES, C. ROBBINS and F. E. GARLAND—Eye, ear, nose and throat clinics, daily
 G. H. WRIGHT—Demonstrations in oral surgery
 J. L. GOODALE—Demonstration The diagnosis and desensitizing of hay fever

BOSTON CITY HOSPITAL

Monday

- J. B. BLAKE, W. E. FAULKNER and L. R. G. CRANDON—9 Operations Surgical
 F. S. NEWELL, E. B. YOUNG, and N. R. MASOV—2 Operations Gynecological
 G. P. SANBORN—3 Demonstration End results in the tuberculin treatment of lymphnodular tuberculosis.
 F. W. WHITE, F. B. LUND and R. D. LEONARD—4 Demonstration Diagnosis and treatment of ulcer and cancer of the stomach (medical, surgical, X ray)

Tuesday

- F. B. LUND, F. J. COTTON, and D. D. SCANNELL—9 Operations Surgical
 PAUL THORNDIKE and assistants—2 Operations Genito urinary
 PAUL THORNDIKE—3 Demonstration Prostatectomy Renal calculus
 HORACE BINNEY—4 Demonstration Treatment of tumors of the bladder with the high frequency current

Wednesday

- E. H. NICHOLS, H. A. LOTHEROP, and J. C. HUBBARD—9 Operations Surgical
 J. B. BLAKE, W. E. FAULKNER and L. R. G. CRANDON—2 Operations Surgical
 J. B. BLAKE—3 Demonstration Splenectomy for Banti's disease
 A. R. KIMPTON—4 Demonstration Transfusion by the use of glass cylinders Bone tumors. Resection of the stomach for sarcoma

Thursday

- PAUL THORNDIKE and assistants—9 Operations Surgical

- F. B. LUND, F. J. COTTON, and D. D. SCANNELL—2. Operations Surgical
- F. J. COTTON—3. Demonstration Artificial impactions in fracture of the hip. Joint affections. Separations of the lower epiphysis of the femur
- F. B. LUND—4. Demonstration Results of operative treatment of fractures, particularly with Parham and Martin bands
- J. H. CUNNINGHAM—4.30 Demonstration Congenital cystic kidney. Results of operations for intestinal tuberculosis. Nephrectomy for acute unilateral hematogenous infections of the kidney
- I. H. LAHEY—5. Demonstration Cardiospasm. Carcinoma of the jejunum. Resection of the rectum with perineal anus

Friday

- F. S. NEWELL, E. B. LADD, and N. R. MASON—9. Operations Gynecological
- E. H. NICHOLS, H. A. LOTHROP, and J. C. HUBBARD—2. Operations Surgical
- E. H. NICHOLS—3. Demonstration Results and methods of operating for osteomyelitis. Cerebral surgery
- H. A. LOTHROP—4. Demonstration A new operation on the frontal sinus
- J. C. HUBBARD—5. Demonstration Sarcoma of the femur. Excision of the transverse colon. Perforation of duodenal ulcer. Transverse duodenal removal of a gallstone. Rupture of the liver

In connection with the operative clinics, special demonstrations will be given where possible of special methods of anesthesia. Intratracheal, spinal, etc., by J. E. BUTLER, F. L. RICHARDSON and N. R. MASON

CHILDREN'S HOSPITAL

Orthopedic Department

- R. W. LOVETT, A. THORNDIKE, ROBERT SOUTTER, A. FURKHEILD, A. T. LEGG, J. W. SEVER, and HENRY J. FITZSIMMONS—Daily, 9 to 11. Orthopedic operations. Reduction of congenital dislocation of the hip by various methods, and especially by a special machine. Tendon transplantations, capsule reefing, etc., in infantile paralysis. The use of silk ligaments in infantile paralysis. The operative correction of club foot. The Hibbs and Albee operations for tuberculosis of the spine. The operative treatment for spastic paralysis. Operations for coxa vara. Bone transplantations.
- R. W. LOVETT—Monday, 2.30 and 5.10. Demonstration The treatment of infantile paralysis by muscle training, with exhibition of patients. The treatment of scoliosis by forcible jackets. Application of jackets and demonstration of results.
- ROBERT SOUTTER and A. T. LEGG—Monday, 3.15. Demonstration Exhibition of the results of the operative treatment of infantile paralysis
- E. G. MARTIN—Monday, 3.30. Demonstration An apparatus to determine the strength of muscles affected by infantile paralysis, with conclusions to be drawn from observations made by it.
- J. J. THOMAS and J. W. SEVER—Monday, 4. Demonstration Obstetrical paralysis and fracture of the acromion process simulating it. Monday, Tuesday and Wednesday, 3. Demonstration Treatment of paralysis by muscle training

A. THORNDIKE—Monday, 3.30. Demonstration End-results in osteoplastic operation for spinal tuberculosis.

PERCY BROWN—Monday, 4.30. Demonstration Röntgen results in osteoplastic spinal operations. Thursday, 4. Demonstration Result of Röntgen investigation in cases of fibrous stenosis of the pylorus in children. Daily, 10 to 4. Exhibition of Röntgenograms, Röntgen department.

ROBERT SOUTTER—Thursday, 3. Operation. A new operation for flexion contraction of the thigh in infantile paralysis.

A. T. LEGG—Thursday, 3.30. Operation Transplantation of the origin of the pectoralis major muscle in paralysis of the shoulder.

A. LARSEN—Thursday, 2.30. Demonstration. Multiple enchondroma

H. J. FITZSIMMONS—Monday, Tuesday and Wednesday, 3. Demonstration Treatment of scoliosis with methods in use, cases and records. Thursday, 4.30. Demonstration Apparatus for reduction of congenital hip dislocations.

PROFS. ERNST, HOLIN, HUNT, CANNON and WOLBACH, DRs. STONE and MORSE—Thursday, 4.30. Clinic Infantile paralysis.

Visit to orthopedic wards daily, 11 to 12. The new hospital buildings will be open to inspection by visitors daily, 9 to 10.

Surgical Department

J. S. STONE, W. E. LADD, C. G. MIXTER and T. W. HARMER—Daily, 11 to 1. Surgical operations. Harelip, cleft palate, empyema, hernia, cervical adenitis, webbed fingers, hypospadias, undescended testis, etc.

C. G. MIXTER—Tuesday, 2.10. Demonstration Imperforate and ectopic anus. Wednesday, 2.30. Demonstration Tuberculous peritonitis. Pyloric stenosis. Undescended testis.

W. E. LADD—Tuesday, 2.30. Demonstration. Cervical adenitis. Wednesday 2.30. Demonstration Intussusception. Harelip and cleft palate.

J. S. STONE, W. E. LADD and J. J. THOMAS—Tuesday, 2.30. Demonstration Fractures in children. Subperiosteal and epiphyseal, elbow joint fractures, Volkmann's ischaemic contractures.

J. S. STONE—Wednesday, 2.30. Demonstration Some obscure abdominal conditions. Empyema. Harelip and cleft palate. Acute epiphyseal lesions.

T. W. HARMER—Wednesday, 2.30. Demonstration The treatment of birthmarks.

PROFS. ERNST, HOLIN, HUNT, CANNON, WOLBACH, DRs. LOVETT, STONE and MORSE—Tuesday, 4.30. Clinic Cervical adenitis.

DRs. CROSBY, GREENE and F. E. GARLAND, three afternoons. Eye, Ear, Nose and Throat clinic. Visit to general surgical wards daily, 10 to 11.

PETER BENT BRIGHAM HOSPITAL

HARVEY CUSHING—Daily. Clinics or demonstrations. Surgery of the brain, pituitary body, spinal cord, peripheral nerves.

DAVID CHEEVER and JOHN HOWANS—Daily. Operations. Surgical.

HENRY A. CHRISTIAN, CHANNING FROTHINGHAM, and others of the medical staff will co-operate in giving clinics or demonstrations on selected topics, such as the electrocardiogram, etc.

MASSACHUSETTS HOMŒOPATHIC HOSPITAL

Monday

- A G HOWARD and H MOORE—9 Orthopedic operations. Bone grafting, tendon transplantation
J H PAYNE and D W WELLS—9 Lye operations. Advancement, pulley stitch, advancement, modified Worth, ptosis, Tansley operation, trephining, glaucoma
DRS RICE, HOUGHTON, and C SMITH—2 Operations. Nose and throat.
W F WESSELHOEFF and T E CHANDLER—2 General surgical operations. Gastric ulcer, ventral hernia, inguinal hernia, appendicitis, oesophageal diverticulum

Tuesday

- J E. BRIGGS and C T HOWARD—9 General surgical operations. Prostate, appendix, gouter, inguinal hernia
G A SUFFA and A W HERR—9 Lye operations. Muscle tucking, advancement, modified Worth, cataract extraction, glaucoma
HORACE PACKARD and C T HOWARD—2 General surgical operation. Appendectomy, a simpler method of sealing the appendicular stump. Demonstration cases. Prostatectomy, the choice of routes. The control of post-operative hæmorrhage, illustrative operations. Empyema, cases for demonstration. Linterptosis, cholelithiasis
DRS RICE, HOUGHTON, and SMITH—2 Operations. Nose and throat.

Wednesday

- DRS RICE, HOUGHTON, JOHNSON, SMITH, and BUSH—9 Operations. Nose and throat.
GEORGE H EARL and H MOORE—9 Orthopedic operations. Congenital dislocation of the hip, bone-grafting, tendon transplantation
W F WESSELHOEFF and R C WIGGIN—2 General surgical operations. Nephrolithiasis
F. W. COLBURN—2 Operations. Ear

Thursday

- J L BRIGGS and C CRANE—9 General surgical operations. Cancer of the breast, appendix, cholelithiasis, nephrolithiasis
DRS RICE, HOUGHTON, and C SMITH—9 Operations. Nose and throat
G R SOUTHWICK—2 Gynecological operations. Ovarian cystomata, retrodisplacement of uterus, uterine fibromata, perineorrhaphy

Friday

- G R SOUTHWICK and D G WILCOX—9 Gynecological operations.
DRS A S BRIGGS, BOYD, LEP, SEDGILL, SOUTHER, and THOMAS—2 General surgical operations.

Demonstrations

- W H WATERS—Surgical pathology
G A SUFFA—Ophthalmotrope
Routine examination of ante-partem cases—Wednesday, 10
Social service clinic for post partem cases—Thursday, 2
Daily clinics in twilight sleep
Daily exhibition of new maternity building

CARNEY HOSPITAL

- J. T. BOTTOMLEY and D F MAHONEY—Monday, Wednesday and Friday, 9 Operations. Surgical
W. R. MACAUSLAND and A R MACAUSLAND—Monday, Wednesday and Friday, 9 Operations. Orthopedic
F W JOHNSON and S RUSHMORE—Tuesday and Thursday, 9 Operations. Gynecological

FREE HOSPITAL FOR WOMEN

- DRS GRAVES, PEMBERTON, WADSWORTH, HUTCHINS and BAKER—Tuesday, Wednesday and Thursday, 9 Operations. Gynecological
DR PEMBERTON—Wednesday, 2 30 Cystoscopic demonstration
DR HUTCHINS—Thursday, 2 30 Demonstrations. Laboratory specimens

ST ELIZABETH'S HOSPITAL

- DRS LANE and SUFFA—Monday and Thursday, 9 Operations
DR CROBIN—Monday, Thursday and Friday, 10 Ward visits. Wednesday, 9 Intravenous salvarsan injections.
DR. BRODERICK—Tuesday, 9 Orthopedic operations and clinic
DR CHUTE—Wednesday and Friday, 9 Operations. Genito-urinary
DRS BRAINERD and HOLMES—Tuesday, 9 Nose and throat clinic
DR DOWNING—Monday and Friday, 11 Demonstrations. Laboratory technique
DR BUTLER—Tuesday and Thursday, 10 Demonstrations. X ray
DRS McDONALD and MCADAMS—Wednesday, 10 Lye clinic

The history, diagnosis, and indication for operation, in each case will be discussed previous to operation by Dr Cronin of the medical service and Dr Butler of the roentgenological department

ROBERT BRIGHAM HOSPITAL

- CHARLES F PAINTER, EDWARD RICHARDSON, LLOYD T BROWN and RICHARD MILLER—Tuesday and Thursday—10 Operations. Monday, Wednesday and Friday, 3 Clinics. Surgery of chronic diseases, arthritis, intestinal tuberculosis, peritoneal adhesions, hemolytic diseases.

NEW ENGLAND HOSPITAL FOR WOMEN AND CHILDREN

MARY A. SMITH and ABBY M. O'KEEFE — Monday and Thursday, 10. Operations. Gynecological.

ELIZABETH T. GRAY and LETITIA D. ADAMS — Monday, 2, Tuesday, 10. Operations. Gynecological.

EMMA B. COLBERTSON and GLADYS COOPER — Tuesday and Friday, 2. Operations. Gynecological.

FLORENCE DUCKERING and LETITIA D. ADAMS — Wednesday, 10; Thursday, 2. Operations. Gynecological.

MARCE CARVILL — Thursday, 2. Eye clinic.

MARGARET NOYES — Wednesday, 2. Ear, nose and throat clinic.

ISABELLE D. KERR — Friday, 10. Ear, nose and throat clinic.

Scopolamine morphia anesthesia both with and without ether will be used during these clinics. Statistics, covering six years continuous use of this form of surgical anesthesia, on over 1400 cases, are available. Dr. Abby M. O'Keefe, professional anesthetist, has entire charge of this department.

LONG ISLAND HOSPITAL

F. H. LAHEY — Monday, 2. Operations.

J. H. CUNNINGHAM — Tuesday and Wednesday, 2. Operations.

ROBERT SOUTTER — Thursday and Friday, 2. Operations.

CODMAN HOSPITAL

E. A. CODMAN — Tuesday, 10. Operations. Surgical. Demonstration of lesions about shoulder joint. Thursday, 10. Operations. Surgical. Demonstration of lesions of duodenum.

HOUSE OF THE GOOD SAMARITAN

DRS. SOUTTER, LEGG and SEVER — Monday, Wednesday and Friday, 10. Clinics. Infantile paralysis, muscle transplantation, flattened condition of the head of the femur, obstetrical paralysis.

MASSACHUSETTS CHARITABLE EYE AND EAR INFIRMARY

DRS. CROCKETT, MOSHER, and EMERSON — Monday and Friday. Otolological clinic.

DRS. JACK, WALKER, POWERS and BLODGETT — Tuesday. Otolological clinic.

DRS. HAMMOND, WHITE and LAUCK — Wednesday. Otolological clinic.

DRS. JACK, KNOWLES, TOBEY and BOGAN — Thursday. Otolological clinic.

Eye clinic daily from 9 to 12. Various operations on lids, tear sac and muscles of the eye. Different types of operation for cataract and glaucoma. Magnet operations for the removal of foreign bodies from the eye. Different methods of using local anesthesia. Tuberculosis of the eye. Interstitial keratitis of specific origin. Ophthalmia neonatorum and gonorrheal ophthalmia in adults. Localization of foreign bodies in the eye by the X-ray. Demonstration of ophthalmometer for measuring astigmatism of the lens. Demonstration of lantern slides by pathological department.

HARVARD MEDICAL SCHOOL

PROFS. COLCATHAN and MALLORY — Demonstration. Pathology.

PROFS. CANNON and W. T. PORTER — Demonstration. Physiology.

PROF. FOLIN — Demonstration. Chemistry.

PROF. STRONG — Demonstration. Tropical Medicine.

PROF. REID HUNT — Demonstration. Pharmacology.

DRS. ORDWAY and TYZER — Demonstration. Cancer research.

JOHN WARREN — Demonstration. Anatomy.

W. F. WHITNEY — Demonstration. Warren anatomical museum.

F. T. LEWIS — Demonstration. Embryology.

J. E. GOLDTHWAIT — Demonstration. Visceroptosis.

TUFTS MEDICAL SCHOOL

A. W. GEORGE — Daily, 2 to 5. Röntgenological demonstration.

SURGERY, GYNECOLOGY AND OBSTETRICS

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TUMORS OF THE BLADDER WITH SPECIAL REFERENCE TO THE TECHNIQUE AND POST-OPERATIVE RESULTS

A SYMPOSIUM¹

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TECHNIQUE OF OPERATIVE TREATMENT OF BLADDER TUMORS

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TUMORS of the urinary bladder are either *primary* or *secondary*. In the latter class are noted such growths as occur by surface implantation extension, descending from the renal pelvis,² and bladder invasion by contiguity from carcinomata of the prostate, and of the abdominal and pelvic viscera. Primary vesical neoplasmata are either *benign* or *malignant*. The benign types include papilloma, angioma, fibroma, myoma, adenoma, and cyst. The malignant tumors are carcinoma, sarcoma, and myxoma.

Reference to these various types is made by virtue of the necessity of a knowledge of intravesical gross pathology respecting their differentiation when possible cystoscopically, thereby determining the proper form of treatment, and if operative, the appropriate procedure. The more experienced the cystoscopist and the greater his knowledge of

living pathology, the more often will his opinion be correct. In view of the deservedly popular and best form of treatment of benign growths or papillomata by endovesical high-frequency electro-coagulation, as opposed to the radical partial resection of the bladder for malignant tumors involving the bladder-wall, and particularly in view of the fact that papillomata and carcinomata comprise at least 90 per cent of vesical neoplasmata, the information yielded and the deductions permissible from cystoscopic examinations in these cases is a matter of first magnitude, and in the vast majority of cases the most important factor in the determination of the proper form of treatment. In 22 consecutive cases that I have observed, 45.4 per cent were inoperable, from the standpoint of cure, when first seen, that is, the diseased area was extensive, unmistakably carcinomatous and in an advanced state. In 22.7 per cent the character of the growth was indeterminable at the time of first cystoscopy, but in only 9 per cent was such the

¹ A noteworthy example of such a condition is that described by Tachert-Hall in a classical case in which autopsy revealed the ureter and bladder lined and literally filled with small secondary papillomata, of viscidly implanted from the large mother tumor situated in the pelvis of the kidney.

² Papers presented at the annual meeting of the American Urological Association, Baltimore, April 13-15, 1915.

NEW ENGLAND HOSPITAL FOR WOMEN AND CHILDREN

MARY A. SMITH and ABBY M. O'KEEFE — Monday and Thursday, 10. Operations. Gynecological.

ELIZABETH T. GRAY and LETITIA D. ADAMS — Monday, 2; Tuesday, 10. Operations. Gynecological.

EMMA B. CLIBERTSON and GLADYS COOPER — Tuesday and Friday, 2. Operations. Gynecological.

FLORENCE DUCKERING and LETITIA D. ADAMS — Wednesday, 10, Thursday, 2. Operations. Gynecological.

MAUDE CARVILL — Thursday, 2. Eye clinic.

MARGARET NOYES — Wednesday, 2. Ear, nose and throat clinic.

ISABELLE D. KEER — Friday, 10. Ear, nose and throat clinic.

Scopolamine-morphia anesthesia both with and without ether will be used during these clinics. Statistics, covering six years continuous use of this form of surgical anesthesia, on over 1400 cases, are available. Dr. Abby M. O'Keefe, professional anesthetist, has entire charge of this department.

LONG ISLAND HOSPITAL

F. H. LAHEY — Monday, 2. Operations.

J. H. CUNNINGHAM — Tuesday and Wednesday, 2. Operations.

ROBERT SOUTTER — Thursday and Friday, 2. Operations.

CODMAN HOSPITAL

E. A. CODMAN — Tuesday, 10. Operations. Surgical. Demonstration of lesions about shoulder joint. Thursday, 10. Operations. Surgical. Demonstration of lesions of duodenum.

HOUSE OF THE GOOD SAMARITAN

Drs. SOUTTER, LECC and SEVER — Monday, Wednesday and Friday, 10. Clinics. Infantile paralysis, muscle transplantation, flattened condition of the head of the femur, obstetrical paralysis.

MASSACHUSETTS CHARITABLE EYE AND EAR INFIRMARY

Drs. CROCKETT, MOSHER, and EMBESON — Monday and Friday. Otolological clinic.

Drs. JACK, WALKER, POWERS and BLODGETT — Tuesday. Otolological clinic.

Drs. HAMMOND, WHITE and FAUVEY — Wednesday. Otolological clinic.

Drs. JACK, KNOWLES, TOLBY and BOGAN — Thursday. Otolological clinic.

Eye clinic daily from 9 to 12. Various operations on lids, tear sac and muscles of the eye. Different types of operation for cataract and glaucoma. Magnet operations for the removal of foreign bodies from the eye. Different methods of using local anesthesia. Tuberculosis of the eye. Interstitial keratitis of specific origin. Ophthalmia neonatorum and gonorrheal ophthalmia in adults. Localization of foreign bodies in the eye by the X ray. Demonstration of ophthalmometer for measuring astigmatism of the lens. Demonstration of lantern slides by pathological department.

HARVARD MEDICAL SCHOOL

PROF. COUNCILMAN and MALLORY — Demonstration. Pathology.

PROFS. CANNON and W. T. PORTER — Demonstration. Physiology.

PROF. FOLIN — Demonstration. Chemistry.

PROF. STRONG — Demonstration. Tropical Medicine.

PROF. RAID HUNT — Demonstration. Pharmacology.

Drs. ORPWAY and TYLER — Demonstration. Cancer research.

JOHN WARREN — Demonstration. Anatomy.

W. F. WHITNEY — Demonstration. Warren anatomical museum.

F. T. LEWIS — Demonstration. Embryology.

J. E. GOLDSWORTHY — Demonstration. Visceroptosis.

TUFTS MEDICAL SCHOOL

A. W. GEORGE — Daily, 2 to 5. Röntgenological demonstration.



Fig 2 Showing the manner of application of high frequency electrode to bladder papilloma. This represents the appearance of a tumor one week after first treatment by the Oudin current, the white area is the coagulated, desiccated or dead tissue the result of the first treatment, the electrode is seen imbedded in the remaining living tissue preparatory to the second treatment

tive to the proper treatment of many vesical tumors. So soon as a papillary growth evidences a marked breaking through of the epithelial cells and an infiltration of round cells at the base, it is assuredly malignant and no longer a papilloma, and should be classed as a carcinoma and subjected to formidable treatment. I have never seen a case of true papilloma, whether single or multiple, that was not destroyed effectively by high frequency electro coagulation, and I have never seen a single case of carcinoma involving the pedicle or bladder-wall that was cured by the electric spark. A papilloma is always a precancerous tumor, and therefore, in accordance with the old definition, malignant. On the contrary, histologically, a papilloma is no more a malignant growth than a common warty wart. If we were more precise in the differentiation of these bladder tumors, I believe a forward step might be taken in the selection of the best method of treatment for each individual case.

The treatment of tumors of the urinary

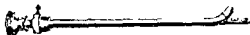


Fig 3 Cystoscope constructed with capsule in beak for carrying radium for topical intravesical applications (after Paschalis)



Fig 4 Author's instrument used for endovesical applications of radium. The graduated shaft is a woven shotted bougie and therefore flexible. Its tip is fitted with a silver capsule, S one millimeter in thickness. Surrounding this is a lead cover, L, one and a half millimeters thick, provided with an oval fenestrum permitting the emanation of the effective radium rays. After cystoscopy, by careful manipulation, it is possible to bring the diseased area in close apposition with the fenestrum and conduct cross-fire emanations.

bladder is dependent upon a number of factors, chief of which are: (1) the organic integrity of the individual, namely, cardiovascular disease, nephritic changes, etc.; (2) the extent of disease, often manifested by infiltration and induration about the base of the bladder on rectal and vaginal examination, or by evidence of vesical metastasis, and (3) the cystoscopic revelations, defining the number, size, character, and location of tumors, and consequently in most cases the nature of the surgical procedure to be adopted. Due consideration of these factors will readily permit of a decision between high frequency electro coagulation and radical operation, or relegate the case to some unfortunate palliative procedure, as suprapubic cystostomy, exclusion of the bladder either by bilateral nephrostomy or ureteral transplantation, or radium emanations.

The treatment of bladder tumors may be considered under two chief forms *non-incisional* and *incisional*.

Non incisional forms of treatment Under this heading may be enumerated: (1) high-frequency electro coagulation, (2) radium, (3) perurethral excision, snare strangulation and cauterization, and (4) irrigations with coagulable solutions. Prominent among

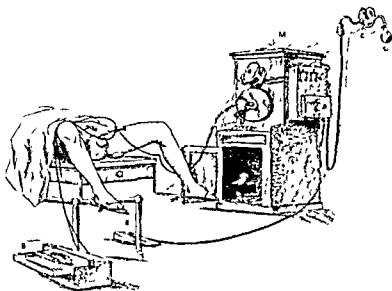


Fig. 1. Arrangement for high frequency destruction of bladder tumors. C, street current; M, high frequency machine; B, battery for illumination of cystoscope; S, foot switch to facilitate the "make and break" of the Oudin current.

case after two or three probationary high frequency endovesical applications. This experience and these figures are based upon the operative findings, the post operative clinical course of cases and in most instances the histopathological examination of removed tissue.

Be it understood, in consideration of the above statements that theoretically and indeed practically in any given case, no cystoscopist, no matter how experienced, can surely state that a particular vesical growth is papilloma or carcinoma. Even though his opinion be correct in 99 per cent of cases, it is merely inferential. The microscope alone can determine the diagnosis absolutely. I have repeatedly observed papillomata undergoing carcinomatous degeneration of their projecting surfaces and in these cases it is merely a question of time until the pedicle likewise becomes involved unless appropriate treatment be instituted. Such a carcinomatous degeneration is amenable to treatment by high-frequency electrocoagulation, and may be cured along with its papillary pedicle. On the other hand, so soon as the pedicle becomes involved similarly to carcinoma of the sessile type, there is but one

form of treatment, if the patient be seen in the operable stage and that is by resection of the bladder transperitoneally or extraperitoneally. In doubtful cases a very few high frequency applications will settle the point and, if no definite beneficial effect be manifest, should decide the question at once in favor of a radical operation. In this connection I desire again to protest against the routine practice of removing per urethram, sections of tumors for microscopical diagnosis prior to surgical intervention. The pre-disposition of this procedure to invite implantation of tumor cells and recurrence, far outweighs any advantage from the diagnostic viewpoint. In full realization of the poor results generally in the past in operations for bladder tumors and on account of the great likelihood of recurrence, it behooves us to avoid incisional forms of treatment whenever possible, that is when the tumor is a papilloma. I deplore exceedingly the term "malignant papilloma," and believe that such terminology is responsible for no little confusion and misunderstanding relative to the treatment of bladder tumors.

¹ The destruction of tumors of the urinary bladder by a high-frequency current effect known as Jexoul's. Surg. Gynec. & Obst. 1912, 15, 515.

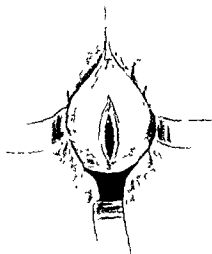


Fig. 7 Bladder pulled forward and incised vertically through its peritoneal covering. The dotted lines show the relationship of subsequent cuts to the tumor.

devitalization (Fig. 2). The dead tissue sloughs away in a few days. Treatments should be given not oftener than twice a week, usually weekly, and frequently at intervals of two or three weeks, depending upon the amount of cellular reaction produced. Great care must be exercised not to desiccate the normal bladder-wall, otherwise perforation might be readily produced. A general anesthetic may be employed, but has never been necessary in our experience.

Technique of the application of radium. Thus far the sphere of the utility of radium in the treatment of bladder tumors has been largely and should be restricted to inoperable malignant growths, and as a post operative prophylactic against recurrence. There is no evidence to warrant its substitution for other established and well recognized methods of treatment for operable benign or malignant neoplasms. Paschkis and Tittinger in 1910 treated successfully a case of sarcoma of the prostate, and the former, the following year, reported on a number of cases of carcinoma of the bladder and prostate, also one of papilloma. The results were poor, due probably to the employment of insufficient radium.

Through the courtesy of Drs. Charles H.

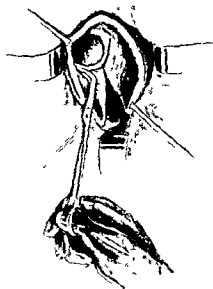


Fig. 8 Exposure of the tumor from the inside, demonstrating the manner of circumcision of the growth.

Frazier and Henry K. Pancoast of the University Hospital. I have utilized radium in two cases to supplement surgical procedures. In each case, approximately 110 mg. of radium sulphate or 50 g. mg. of the element radium were employed. Preferably, in extensive inoperable tumors it is best applied through a suprapubic vesical opening, imbedding the capsule in the pathological tissue at various sites for the sake of cross-fire. The capsule, enclosed or not in a rubber tube or catheter, is allowed to remain in one position for two to twenty-four or more hours. The emanations may also be applied to bladder lesions through the urethra. This may be effected with a cystoscope carrying the element as was done by Paschkis (Fig. 3), or especially in cases of involvement of the neck by the careful manipulation of a carrier (Fig. 4) after previous determination by cystoscopy of the exact location of the growth. Possibly in the future, with the employment of enormous dosage, taking care to cut off all but the gamma and deep-penetrating rays, the dura-



Fig 9 Showing appearance of the bladder after excision of tumor bearing area involving the distal end of the ureter. The latter has been reimplanted through a stab in the bladder wall.

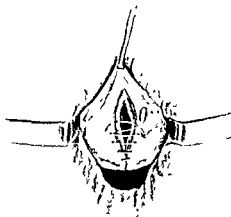


Fig 10 Illustrating manner of suture for closure of the bladder. Observe that the Connell suture is modified to exclude the mucosa instead of passing through all the coats of the bladder. A running mattress suture of linen through the peritoneum usually supplements and reinforces the primary deep suture.

tion of treatment may be shortened and its effectiveness greatly increased. It will be remembered however, that radium cannot supersede surgery.

Perurethral excision snare strangulation, and cauterization. These comprise endovesical operative procedures introduced by Nitze and practiced by a few expert cystoscopists. From the standpoint of treatment today, they are obsolete as contrasted with the superior advantages of high-frequency electrocoagulation. Diagnostically it is rarely permissible or necessary to excise punch out or snare off a portion of a bladder tumor. Should it be found advisable to resort to this procedure in a given case, Bucrger's operating cystoscope employing the cutting or punch forceps or Young's cystoscopic rongeur, will serve the purpose admirably. Such methods invite implantation metastasis and should be condemned as routine practices. The technique is precisely that for cystoscopy and needs no description at this time.

Irrigation with coagulable solutions. The idea, that by irrigation of the bladder with certain medicated solutions supposed to

exert a coagulating influence on tumors and hence their disappearance, is exploded. However following the removal of vesical neoplasms it is still permissible if not advisable, to practice prophylactic irrigations, thereby preventing recurrences from stray tumor cells. The best solution for the purpose is resorcin in 2 to 10 per cent strength, begun as soon as expedient after operation and continued at semiweekly intervals for two or three months.

Incisional forms of treatment. The operative treatment of bladder tumors referring particularly to carcinoma is one of the most difficult in surgery. This is due first to the inaccessible location of the majority of vesical tumors and second to the difficulties encountered in preserving the urterovesical relationship necessitating in many cases abnormal derivation of the urine. The operative treatment may be either *radical* or *palliative* dependent upon the decision as to whether or not the tumor is completely excisable and the condition of the patient warrants a formidable operation. The forms of radical treatment are two (1) *partial*

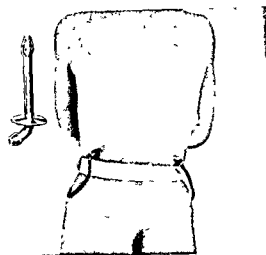
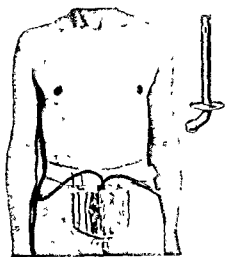


Fig 11a (at left) Illustrating apparatus for renal drainage. The nephrostomy wounds are permitted to granulate around sterling silver tubes constructed as shown in sketch. If phosphatic deposits form in the tubes, necessitating their removal, the bulbous extrem-



ities must be cut off and the tubes held in position by adhesive plaster. Light rubber tubing conducts the urine around the flanks to a reservoir suspended in the hypogastric region.

Fig 11b same as 11a, front view

cystectomy and (2) total cystectomy. The choice between the two obviously depends upon the extent of vesical involvement by the tumor, if both ureteral orifices or the neck of the bladder be involved, the only operation offering a prospect of cure is the complete removal of the bladder. Irrespective of the high mortality (10 to 20 per cent for partial and 45 to 60 per cent for total cystectomy), I feel that the doctrine — too commonly expressed in cases of carcinoma regardless of conditions — of performing cystotomy for drainage and letting the patient die under morphine narcosis is not only derogatory to advancement in vesical surgery but positively erroneous in many instances. Undoubtedly in the past surgeons have refused or feared to attack the bladder boldly, as they do other organs notably the stomach, and have been content simply to open the bladder and curette or cauterize the tumor-mass. Such practices often add insult to injury, invite rapid growth of the tumor with extensive metastasis, and leave the patient worse off than before surgical intervention. If a definite though formidable, operative procedure be planned at the outset, having in view resection or even complete removal of the bladder, extraperitoneally or intra-

peritoneally, necessitating in the majority of cases reimplantation of one or both ureters, I believe that we can cure a certain number of patients with carcinoma of the bladder, who otherwise are pronounced incurable and soon become human derelicts.

Partial cystectomy. This operation may be done by either of two routes: (1) *intra-peritoneally* or *transperitoneally* and (2) *extra-peritoneally*. Choice as to the particular route in a given case is often dependent upon the revelations of cystoscopy, that is, the exact location, size, and character of the growth. Certainly if the tumor (carcinoma) be situated in that part of the bladder covered by peritoneum, it is always advisable, if not obligatory to open the peritoneal cavity. The operator may then determine whether or not the peritoneum, lymphatics, liver or other abdominal viscera have been involved by the growth. If the first be true a wide block resection of the entire bladder-wall and overlying peritoneum will be necessary, if metastasis has occurred a formidable vesical operation will prove useless and should not be done. With such pathological conditions present, it is obvious that an extraperitoneal operation, other than as a palliative cystotomy for drainage, would be not only erroneous,

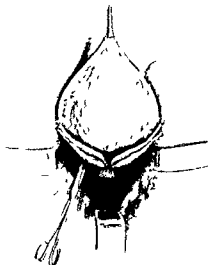


Fig. 12 Simple extraperitoneal total cystectomy. The bladder is forcibly pulled anteriorly and downward over the pubes. The vasa deferentia and ureters are shown ligated and the scissors are freeing the vesical neck preparatory to severance.

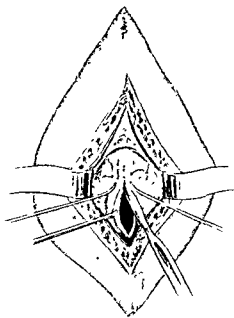


Fig. 13 Illustrating method of opening the bladder through suprapubic extraperitoneal incision.

but leave the patient worse than if no surgical intervention at all had been attempted. Thus, all things being equal, in view of the proved facts — (1) that normal urine is but slightly irritating to the peritoneum and unlikely to lead to infection as demonstrated by the reported recoveries after intraperitoneal rupture of the bladder, (2) that transperitoneal cystostomy can be successfully accomplished, even in the presence of severe cystitis, and (3) that the mortality, following the intraperitoneal route is less than half that following extraperitoneal resection — the writer strongly favors surgical attacks on the bladder, differing in no wise from those commonly practiced on the stomach. Such is the transperitoneal resection of the bladder as suggested by Rydygier performed by Harrington, and popularized by Mayo.

The technique of transperitoneal partial cystectomy is as follows. The bladder is thoroughly lavaged with some solution, as boric acid or silver nitrate. This can be done through the sheath of a cystoscope, supplemented when possible by bilateral ureteral

catheterization. The catheters may be serviceable in locating the ureters as they course through the pelvis to the bladder, but chiefly in preventing peritoneal contamination, while the bladder is being resected by permitting no leakage of urine into the bladder. If the bladder has been distended with fluid it must be emptied before it is incised.

A vertical median incision, extending from the symphysis almost or quite to the umbilicus, is made down to, and through, the sheath of the recti muscles. These are separated by the scalpel handle as shown in Fig. 5, and may be undercut on one or both sides to give ample exposure. In very stout individuals the semilunar transverse incision with convexity downward (Fig. 6) may be employed to advantage. The peritoneum is then incised, the intestines packed off and, along with the peritoneum and edges of the wound protected by gauze pads. The bladder is lifted with Schoenberg's or Allis' forceps, inspected for peritoneal invasion by the growth opened as shown in Fig. 7, and sponged out as thoroughly as possible. With the

patient in the Trendelenburg position, and the bladder pulled well forward, a second cut with scissors through all coats is made in the direction of the tumor (dotted line, Fig. 7). This cut is carried to within two centimeters of the tumor. Then with angulated scissors the growth is circumcised through all coats at a distance of two to three centimeters from its periphery (Fig. 8). Following the resection of the tumor-bearing area, the cut edges of the bladder-wall should be cauterized or receive applications of a strong solution of resorcin, 25 to 50 per cent. Frequently it will be necessary to resect a fourth or a third of the bladder. It will be recalled that a half or even two-thirds of the bladder has been successfully excised, and although at first much restricted in size, it is surprising to observe how soon the viscus will enlarge to satisfactory proportions. Should the ureteral orifice be involved by the growth, the terminal end of the ureter is exposed by making traction on the circumcised tumor-bearing area, ligated, delivered through a small peritoneal incision close to the bladder, and reimplanted through a stab wound in healthy vesical tissue. This is accomplished by longitudinal bisection of the ureter for a distance of one and a half centimeters, or by oblique section of its end, suturing the edges to the vesical mucosa (Fig. 9). The exposed extravescical part of the ureter is covered by a fold of peritoneum.

It is advisable, unless obliged to do so in order to remove all diseased tissue, that the resection should not approach nearer than one centimeter of the vesical orifice. In extensive resections of the floor of the bladder, there may result a small space which is difficult or impractical of closure. This need occasion no great concern as it will probably heal satisfactorily by granulation. As a rule, however the vesical incisions, both oblique and longitudinal, are easily and securely closed by the running mattress or Connell suture. The usual practice has been to include all coats in the employment of this suture. The writer has modified the introduction of this suture by exclusion of the mucosa in a few cases with entire satisfaction (Fig. 10). A supplementary run-

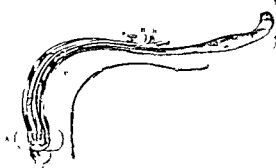


Fig. 14. Author's bladder retractor. The instrument is capable of introduction through a small vesical incision, after which the cross-blade is readily swung into position. The electric lamp is powerful and durable and the carrier is easily detached for purposes of sterilization.

ning suture of linen, including the peritoneum, parallel to the deep suture, is introduced and reinforces the latter.

Unless the bladder presents evidence of marked infection, or the ureter has been transplanted, it is unnecessary to drain either the peritoneal cavity or the bladder. If a small area in the base of the bladder has been allowed to remain unsutured, or the bladder is in a condition of extensive cystitis, a counter-incision should be made and the bladder drained extraperitoneally through the space of Retzius. Usually patients are able to void small quantities of urine frequently and will be more comfortable without than with a catheter. If vesical irritability or tenesmus persists, irrigations with small quantities of warm boric acid solution will prove serviceable.

So soon as expedient, vesical lavage with a 2 to 10 per cent solution of resorcin, as described above, should be practiced on the assumption that it possesses prophylactic value against recurrences.

The technique of extraperitoneal partial cystectomy varies with the location of the tumor. For tumors situated on the anterior wall of the bladder, the procedure recommended by Hagner¹, consisting essentially in outlining the boundaries of the growth by the introduction, suprapubically, of sutures denuded by cystoscopy, followed by wide excision of the tumor, possesses merit. Un-

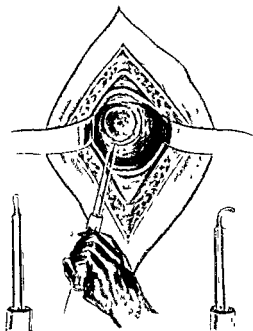


Fig. 15. View of tumor with electro-cautery knife. The knife with curved blade has been useful in freeing the tumor from its sub-tratum.

fortunately, however, few tumors frequent this portion of the bladder.

Growths situated on the sides of the bladder-wall particularly, but also those occupying the fundus and posterior wall are often most satisfactorily operated upon by the technique so lucidly and graphically described by Squier.¹ The operation is not strictly an extraperitoneal one, and should be regarded as a combination of the extraperitoneal and intraperitoneal routes. The steps in the procedure are (a) an incision down to and through the sheath of the recti muscles extending from a point a little above and to the left of the umbilicus to the symphysis pubis, the peritoneum is opened, the patient placed in the Trendelenburg position and the intestines displaced and protected by gauze in the upper abdomen, (b) the peritoneum and urachus are grasped and the obliterated hypogastric arteries exposed, (c) the vasa deferentia are located coursing along the

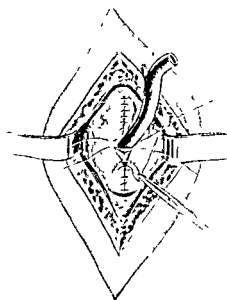


Fig. 16. Showing placement of sutures for closure of the bladder, especially for water-tight security of drainage tube. Observe two-way tube useful for continuous irrigation or by clamping inlet attachment serviceable for suction drainage.

wall of the pelvis inside the hypogastrics, (d) the ureters are exposed above the pelvic fascia as they are about to enter the bladder, by following down the vasa deferentia, (e) the peritoneum is stripped from the bladder posteriorly and laterally, and the flap turned up completely protecting the peritoneal cavity, (f) the bladder is forcibly pulled forward and incised vertically in the mid-line on its posterior surface, (g) counter-incisions are then made differing in no essential from the procedure described under transperitoneal resection, (h) the peritoneum is closed and the bladder sutured as previously detailed, (i) the bladder is drained by catheter inserted through and sutured to a stab wound anteriorly, (j) the abdominal wound is closed about a wick drain introduced to the site of ureteral anastomosis.

Total cystectomy. This is a desperate surgical procedure rendered doubly grave

by the fact that as a rule operators, in the past, have attempted to perform at one time a two stage operation. Although a high operative mortality is ever to be expected, undoubtedly the present figures will be much reduced so soon as surgeons appreciate the fact that the primary operations must be restricted solely to a satisfactory derivation of the urine, leaving the removal of the bladder for a subsequent operation. As has been inferred, the disposal of the urine becomes the chief concern in total cystectomy. Two methods are feasible, first, transplantation of the ureters and second, bilateral nephrostomy. The writers have been transplanted variously to the rectum, colon, appendix, urethra, vagina, loins, and suprapubically, and consequently to no site with uniform satisfaction. Maydl's operation with transplantation of the trigonum is invariably impractical in tumors of the bladder. Few patients have survived ascending infection of the kidneys sufficiently long after implantation of the ureters into the intestinal tract to warrant the procedure. Implantation into the urethra has not proved successful. A few successes have been reported from ureterostomies suprapubically and many have been transplanted to the loins, but as a rule the ureteral openings become strictured and renal infection supervenes. Undoubtedly vaginal implantation is the logical and best procedure in the female, but only a small minority of vesical tumors occur in women.

Realizing the poor results that obtained following ureterostomy and particularly the association of ureterostomy with total cystectomy at a single operation, Watson, in 1905, recommended preliminary bilateral nephrostomies supplemented by total cystectomy at a later operation. In a personal communication recently received, Watson reiterates his proposition of 1905. He states "The chief causes for the mortality attendant hitherto upon the operation of total cystectomy in cases of vesical tumor are two—shock and renal infection. Shock is largely due to two things first the operations have been done under manifestly improper conditions namely when the patients are already greatly exhausted by the long continuance

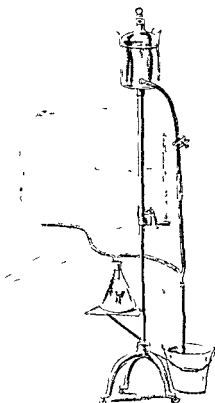


Fig. 17. Hydrostatic suction apparatus for aspiration and drainage of bladder.

of a malignant disease and in most of them when metastases are present, second the operation of removing the bladder has been greatly prolonged by the fact that the ureters are implanted at the same time that the operation for removing the bladder is done.

"The second fatal element in these cases thus operated is due to the fact that renal infection supervenes because the ureters are implanted in the intestine or the vagina and—though in less degree injurious—to the body surface.

"In view of these things I proposed to lessen the operative mortality first by applying the operation of total cystectomy only to such patients as retained at least a fairly good power of resistance and who were not greatly reduced by the cachexia of malignant disease and did not in all probability have any metastases and second by doing away

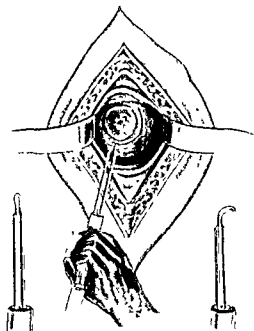


Fig. 15 Excision of tumor with electro-cautery knife. The knife with curved blade has been useful in freeing the tumor from its substratum.

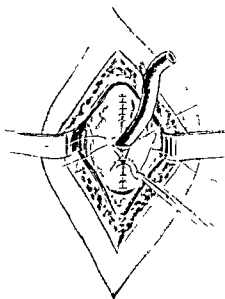


Fig. 16 Showing placement of sutures for closure of the bladder, especially for water tight security of drainage tube. Observe two-way tube useful for continuous irrigation, or, by clamping inlet attachment serviceable for suction drainage.

fortunately, however few tumors frequent this portion of the bladder.

Growths situated on the sides of the bladder-wall particularly, but also those occupying the fundus and posterior wall are often most satisfactorily operated upon by the technique so lucidly and graphically described by Squier.¹ The operation is not strictly an extraperitoneal one, and should be regarded as a combination of the extraperitoneal and intraperitoneal routes. The steps in the procedure are (a) an incision down to and through the sheath of the recti muscles extending from a point a little above and to the left of the umbilicus to the symphysis pubis, the peritoneum is opened, the patient placed in the Trendelenburg position and the intestines displaced and protected by gauze in the upper abdomen, (b) the peritoneum and urachus are grasped and the obliterated hypogastric arteries exposed, (c) the vasa deferentia are located coursing along the

wall of the pelvis inside the hypogastrics, (d) the ureters are exposed above the pelvic fascia as they are about to enter the bladder by following down the vasa deferentia, (e) the peritoneum is stripped from the bladder posteriorly and laterally, and the flap turned up completely protecting the peritoneal cavity, (f) the bladder is forcibly pulled forward and incised vertically in the mid-line on its posterior surface, (g) counter-incisions are then made differing in no essential from the procedure described under transperitoneal resection, (h) the peritoneum is closed and the bladder sutured as previously detailed, (i) the bladder is drained by catheter inserted through and sutured to a stab wound anteriorly, (j) the abdominal wound is closed about a wick drain introduced to the site of ureteral anastomosis.

Total cystectomy. This is a desperate surgical procedure rendered doubly grave

cystectomy. If the growth has involved the peritoneum, an intraperitoneal or transperitoneal operation must be done, the steps of which have been previously detailed. Otherwise the peritoneum is reflected from the fundus and posterior aspect of the bladder, keeping close to the musculature of the viscus or as the base of the organ is approached, the line of cleavage may lead the dissection between the deep layers of the divergent pelvic fasciæ and away from the vesical neck. The vasa deferentia are isolated and severed between double ligatures, the seminal vesicles exposed and the ureters cut between ligatures (Fig 12). Exerting considerable traction anteriorly and downward, the bladder is pulled over the symphysis, and its neck cut across with long curved scissors or the electrocautery. Hemorrhage may be controlled only by packing.

In those cases requiring removal of the prostate, prostatic urethra, and internal vesical sphincter, as in case No. 15, herein reported, it is advisable, as a preliminary step, to free the prostate and vesical neck and sever the membranous urethra through a perineal incision, similar to that in the operation of radical prostatectomy for carcinoma. This procedure greatly facilitates the suprapubic removal of the bladder, whether by the extraperitoneal or combined intraperitoneal route. The exigencies of the particular case may demand that the primary cystectomy be supplemented at a later time by perineal prostatic-urethrectomy.

Total cystectomy in the female may be done by Pawlik's method. The ureters are exposed per vaginam, ligated close to the bladder-wall, severed, and implanted into the vaginal wall. A few weeks later the bladder is separated from the peritoneum through a suprapubic incision, a second incision is made through the vaginal wall above the urethra and the bladder delivered into the vagina and removed by severance of the urethra. The latter is anastomosed to the vaginal wall and at a subsequent operation the vaginal orifice is closed, forming thereby a suitable urinary reservoir or artificial bladder, conveniently drained by the deflected urethra.



Fig 10 Suprapubic bladder drainage apparatus. The cup is provided with two outlet tubes for conducting the urine to the urinal. A fenestrated rubber tube attached to the inside of the cup passes into the bladder. A trap door permits of inspection of the interior of the cup when the apparatus is in position.

The *palliative operative treatment* of bladder tumors comprises the well known operations. (1) suprapubic extraperitoneal cystostomy with excision, cauterization or high-frequency sparking or radium applications to the tumor mass, (2) simple suprapubic cystostomy, and (3) exclusion of the bladder.

Suprapubic cystostomy. The bladder is filled with boric acid solution. The patient is placed in the Trendelenburg position. A vertical incision three inches in length, is made extending upward from the symphysis pubis down to and through the sheath of the

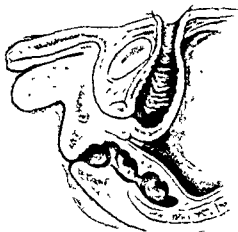


Fig. 18 Showing correct position of bladder in supra-pubic cystostomy. Note that the cut edges of the bladder have been sutured to the skin.

by means of a preliminary operation with the time consuming procedure of diverting the urine into a new channel. Next in view of the great fatality from renal infection due to ureteral implantation I proposed that this procedure be abandoned and that there be substituted in its place as a preliminary step to removing the bladder bilateral nephrostomy and that at whatever time after the patient should have recovered from that operation the total cystectomy be done. I suggested likewise that the bilateral nephrostomy and tying off of the ureters near the renal pelvis could be done as a palliative operation in cases of hopeless vesical tumor and very painful vesical tenesmus in vesical tuberculosis.

Impressed with this doctrine and realizing the lesser liability of kidney infection in nephrostomy as compared with ureterostomy, hence the opportunity to effect a permanent cure, and at the same time mindful of the necessity of a comfortable and efficient renal drainage apparatus I determined, about one and a half years ago, to execute Watson's suggestion in exact detail on a patient No. 15 in table "Summary of Results," presenting multiple recurrent inflamed polypi occupying the vesical base and neck and the prostatic

urethra. The left kidney was first nephrostomized to a lumbar incision after ligation of the ureter with chromic catgut close to the renal pelvis. (This ligature subsequently was prematurely absorbed necessitating re-ligation with silk.) Five and a half weeks later the right kidney was nephrostomized and the ureter ligated with silk. The patient convalesced satisfactorily and was equipped with the drainage apparatus shown in Fig. 11, which fulfilled the requirements of dryness, comfort, and lightness extremely satisfactorily. Light and a half months later total cystectomy, employing the combined trans-peritoneal and extraperitoneal methods, was performed. The patient made a remarkable recovery, left the hospital with his drainage apparatus intact and engaged in light work. Four and a half months later, owing to deep urethral irritation he was re-admitted and subjected to a radical prostatic-urethrectomy. From this operation he also made a notable recovery, and throughout this time up to the present his renal drainage and function have been almost perfect. In view of the success which has attended the operative procedures in this case I feel that it should be recorded, since Watson writes me respecting his proposition for cystectomy, saying "I know of no case in which it has been literally followed out except your own."

Provided the patient has not passed into an inoperable condition owing to extension of his growth or organic state, the operation of total cystectomy is indicated in the following vesical conditions: (1) single or multiple growths covering a wide extent of the bladder-wall (not papillomata), (2) growths involving both ureteral orifices, the entire trigonum, the vesical orifice or the prostatic urethra, and (3) intractable cystitis.

Total cystectomy may be performed either *extraperitoneally* or *intraperitoneally* or both. It may be limited to a *simple suprapubic* excision of the viscus or combined with a perineal operation, comprising then a *perineo-suprapubic* cystectomy or a *cysto-prostatic-urethrectomy*.

The technique of total cystectomy, so far as the preliminary care of the bladder is concerned, differs in no respect from partial

tion, or radium applications, incidentally to remove blood clots and afford better drainage, the operative procedure is expedited to the fullest degree. The electro-cautery, equipped with heavy platinum cautery knives mounted in mineral handles (Fig. 15), capable of being boiled, is undoubtedly the most serviceable instrument for this purpose. The bladder is closed water tight about a drainage tube by a continuous suture of catgut, avoiding the mucosa. A secondary or reinforcing running suture of the Lembert type completes the closure of the bladder (Fig. 16). The specially constructed two-way drainage tube shown in the latter figure has proved very satisfactory, particularly when continuous irrigation is used. A clamp placed on the small inlet attachment of the drain permits of its use in connection with hydrostatic suction apparatus (Fig. 17).¹ The drainage tube should not project too far into the bladder and should be placed well up toward the fundus.

Suprapubic cystostomy. Not infrequently in these incurable cases any operation, other than simple suprapubic cystostomy, is inadvisable. The operation becomes necessary for the removal of clots, to stop hemorrhage, to relieve pain, and to permit of urinary drainage. The technique of the procedure differs little from that of cystotomy. The incision through the bladder should be made well up toward the fundus and the vesical wall should be sutured to the skin (Fig. 18). Obviously this means a permanent suprapubic fistula, necessitating some such apparatus as shown in Fig. 19 after the patient is permitted to be out of bed. While the patient is bed-ridden, the Pool aspirator will prove most serviceable.

Exclusion of the bladder. Reference has already been made to this procedure in the discussion of the operation of "Total Cystectomy." The determination as to the best disposal of the ureters or derivation of the urine in cases of incurable malignant tumors of the bladder is one of the foremost problems of urological surgery today. Until re-

cently the consensus of surgical thought has favored the belief that the danger of immediate mortality and ascending renal infection from the transplanted ureters is greater than any amelioration of symptoms through operative procedures, in view of the rapidly progressive fatal nature of the disease. Undoubtedly, the given case must be decided on its own merits, and a decision reached between lumbar, rectal, or vaginal ureteral implantation, bilateral nephrostomy, and simple suprapubic cystostomy. It is probable, in view of lesser likelihood of renal infection and improvements in the construction of kidney drainage apparatus, that the future will see more nephrostomies performed in accordance with the suggestions of Watson.

Irrespective of the character of the vesical tumor, whether benign or malignant, or the method of treatment, whether by high frequency destruction, the electro-cautery or radical resection of the bladder, the patient should be routinely and periodically cystoscoped for an indefinite time after the removal of his vesical growth. My rule is to advise the patient to report for reexamination cystoscopically, every three months the first year, twice the second year and again at the conclusion of the third year, in order that recurrences may be discovered in their incipency. Recurrences may appear even after the three year time limit, so that the importance of supplementary cystoscopic examinations cannot be too strongly emphasized.

An analysis of the 22 cases² tabulated in this paper shows that 50 per cent of the patients are dead. Of these eleven cases, nine were pronounced inoperable when first seen, except as a palliative measure, of the remaining two, one was cauterized suprapubically instead of being subjected to a partial cystectomy the other refused operation. It is notable that the patients with carcinoma (excepting the papillary form) have invariably died. Of those who died only one patient lived longer than a year after his treatment or cystoscopy. Six patients had been previously operated upon, five of whom at the time of

¹ The most ingenious and effective suction drainage apparatus is that devised by Pool, comprising a double metallic tube the outer one of which is fenestrated, the inner one provided with a trap to prevent vacuum created in a back flow. This drain is connected with and operated by an ordinary suction pump attached to a convenient faucet.

² Since the presentation of this paper, the writer has had the opportunity to treat 17 high frequency electro-coagulation four additional cases of papilloma of the bladder. One of these was cured by two applications of the Oudin current, the other three are still under treatment, although markedly improved.

SUMMARY OF RESULTS OF TREATMENT OF BLADDER TUMORS

No	Initials	Age	Sex	Character of Tumor	Duration of symptoms in M. with	Previously Operated	Operable Radically	Operable by High frequency Electro-Coagulation	Inoperable Except as Palliative Measure	Time from Operation to Recurrence or Present in Months	Time from Operation to Death in Months	Condition at Last Examined from
1	J S	68	M	Carcinoma	72	No	No		Suprapubic cystostomy		1	Dead
2	C T	75	M	Carcinoma	24	No	No		Suprapubic cystostomy		1	Dead
3	W H	39	M	Carcinoma	12	No	No		Suprapubic cystostomy		2	Dead
4	I G A	61	M	Papillary carcinoma	18	No		Yes		12		O K
5	J B H	54	M	Carcinoma	45	Yes	No		High frequency	3	12	Dead
6	M F D	51	F	Carcinoma	48	Yes	No		High frequency		16	Dead
7	G E S	44	M	Carcinoma	12	Yes	No		High frequency		8	Dead
8	C G	45	M	Papilloma	0	No		Yes		45		O K
9	F E B	60	M	Papilloma	52	Yes		Yes		27		O K
10	H G S	54	M	Papillary carcinoma	14	No	Yes suprapubic and cautery	Yes		16		O K
11	E R	71	M	Papilloma	48	No		Yes		40		O K
12	S H	77	F	Carcinoma	2	No	No		Yes		14	Dead
13	C N C	52	M	Carcinoma	96	Yes	No		Suprapubic cystostomy		3	Dead
14	G D W	64	M	Carcinoma	9	No	No		Cystostomy electro-cautery radium	9		O K
15	W A	38	M	Multiple polyps	21	Yes	Yes bilateral nephrectomy and total cystectomy; post-operative radium			7		O K
16	W I	40	M	Papilloma?	2	No	Yes suprapubic and cautery				5	Dead
17	M A	62	M	Carcinoma	24	No	No		Suprapubic cystostomy		6	Dead
18	J N	48	M	Carcinoma	3	No	Yes resected				6	Dead
19	J L C	20	M	Cysts	1	No		Yes		42		O K
20	R E H	70	M	Papilloma	120	No	Yes			9		O K
21	S Y H	53	M	Papilloma	72	No		Yes		18		O K
22	S J F	48	M	Papilloma	36	No		Yes		1		O K

recti muscles. These are separated by blunt dissection and the bladder-wall is exposed. Near the upper angle of the wound the peritoneal reflection must be recognized in the fat and carefully retracted up out of the way. The bladder-wall is securely caught on either side of the median line by sharp hooks and the viscus is opened (Fig. 13). Retractors are now introduced into the cavity of the bladder in an effort to obtain a satisfactory exposure. The main distress of the surgeon has arisen in the past from improper or poor

retraction and exposure in this operation. In Fig. 14 is illustrated a retractor which has proved most useful in the author's experience. With two such instruments the exposure of the base of the bladder including the ureteral orifices, is almost perfect.

Inasmuch as this operation is undertaken with little or no idea of cure, but simply to prolong life by retarding the growth of the carcinoma by removing as much as may be possible through excision with or without cauterization, high frequency electro-coagula-

one patient, who had seventeen small papillomata scattered over various portions of the bladder. He had had a suprapubic excision one year previously. The tumors were all small and were destroyed in four applications. In seven of these cases the tumors were cystoscopically of the benign type; they were definitely pedunculated and had very fine delicate papillae. In all of these eleven cases the tumor disappeared entirely, and in none, up to the present time, has a recurrence been observed in the bladder, although one case has since died of carcinomatous metastases. This case is of particular interest.

The patient, age 48, had a history of hematuria of several years' duration. He consulted a surgeon who diagnosed the condition bladder tumor and advised suprapubic drainage for relief of urinary symptoms because it was considered that the tumor was inoperable. At operation a large papillary tumor was found on the left lateral wall of the bladder, and because of its apparent hopelessness nothing was done except to establish a suprapubic fistula. He was seen about four months after this operation, and it was decided to try the effects of fulguration, although very little hope of a successful result was entertained. The tumor was vigorously fulgurated through the suprapubic fistula by means of the Young fulgurating sound, and later direct fulguration through the cystoscope was carried out. At the end of two months no tumor could be seen in the small contracted bladder, and it was decided to close the suprapubic fistula, a procedure which was carried out. At operation the most careful search of the bladder failed to show any evidence of tumor, and small pieces of bladder wall snipped off from various portions and examined microscopically failed to show the slightest indication of any tumor. For the next nine months the patient was apparently entirely comfortable except for frequent urination from his contracted bladder. Examination then showed, however, evidences of carcinoma of the prostate, which was the result either of a metastases or of implantation from the old bladder tumor. Later on he developed spinal metastases and died eighteen months after the bladder had been cured, and even though there developed no recurrence locally. Although no tissue was obtained in this case for microscopic examination the end result proves very conclusively that the tumor was malignant.

RESULTS IN MALIGNANT PAPILLOMATA

In seven of the sixteen cases in which a histological diagnosis of malignant papilloma was made, the tumors were multiple. In one of these cases, more than a hundred small

tumors, varying from 1 mm. to 0.5 cm., were scattered in all portions of the bladder. In this case five large papillary tumors had been removed suprapubically some months previously and these tumors represented recurrences. In another case the bladder mucous membrane was literally completely covered with papillomatous tumors so that one could see but small portions of mucous membrane even when the bladder was opened. Five of these sixteen tumors had had previous operative procedures of varying kinds—either resection, excision with clamp and cautery, or cauterization with the actual cautery. In ten cases the tumors were entirely destroyed. One case is still under treatment. This is a patient, aged 77, with a malignant papilloma several centimeters in diameter near the right ureteral orifice. Fulguration destroyed about two thirds of the tumor, but as the tumor seemed very resistant it was decided to substitute radium, which is now being applied. One case died while under treatment, but the tumor in this case had almost disappeared. In two cases the tumors resisted absolutely, although in each instance the tumor was small and was frequently and vigorously burned. In both of these cases examination of the tissue obtained showed tumors very malignant in character with definite infiltration of the connective tissue axis. In one of these cases the tumor seemed rather to be stimulated and grew under fulguration to several times its original size. A successful resection was subsequently performed and the patient has now been well over two years. The other patient developed multiple tumors and died of a cardiac condition following a senile dysentery. In one case, owing to the feebleness of the patient and a bad myocarditis, treatment was desisted in after a sufficient number of the tumors had been removed from around the vesical orifice to permit freedom of urination. This patient had a markedly contracted bladder and had had three previous suprapubic excisions of multiple papillomata. He died a few months later of the cardiac condition. The tumors in this case were very responsive, and if treatment could have been continued it would have been

when the tumor is on the posterior or posterolateral wall, gives the necessary information. Again, valuable information may be obtained from X-ray examination with the bladder filled with collargol or other shadow-casting substances. The presence of infiltration of the bladder-wall, the extent of this infiltration, or sometimes the pedunculated character of the tumor, will be astonishingly revealed. On cystoscopic examination, a nodular condition of the mucous membrane around the tumor mass or the presence of edema or a bullous condition of the mucous membrane is almost invariably an indication of infiltration. Where the combination of diagnostic methods fails to make the diagnosis, the results of fulguration will help to settle it. Some difficulty arises in differentiating between multiple papillomata fused on the surface and the diffuse papillary carcinoma, but in our experience this difficulty has seldom occurred. More difficulty will be experienced in differentiating between papilloma and small papillary carcinomata which may resemble each other cystoscopically.

PATHOLOGY OF PAPILLOMATA

The surface character of these tumors varies considerably. More commonly innumerable small villous or papillary projections give the surface a shaggy appearance. In other types the villi are soft, more compact and resemble, when seen in the bladder the surface appearance of a raspberry. They are extremely friable, and when a portion is seized with a clamp, it readily tears asunder. The central portion of the tumor is usually firmer because it contains more of the connective tissue stroma. The tumor mass overhangs the pedicle, and, mushroom like, conceals its point of attachment to the bladder-wall. The pedicle is usually short although occasionally a pedicle so long that it allows considerable excursion of the tumor mass in the bladder cavity is observed. The consistency of the pedicle varies somewhat with the amount of connective tissue which it contains but it is always firmer than the periphery of the tumor. In most instances it is impossible from the gross appearance to decide the character of the growth so

closely in general appearance do the benign and malignant papillomata resemble each other. The pedicle in the malignant papilloma may be freely movable over the underlying mucosa and there may be nothing in the appearance to reveal its malignant character. In the vast majority of cases the differentiation between the benign and malignant papilloma can be made only by the most careful microscopic study and it sometimes necessitates the examination of sections from various portions of the tumor. Indeed, occasionally, even careful microscopic study fails to reveal the true nature of the growth. In many malignant papilloma the cancerous nature is at once apparent both in general architecture as well as in the epithelial infiltration of the connective-tissue framework, but at other times the histological picture may resemble on superficial examination a benign papilloma. In the benign papilloma the connective-tissue axis is lined by an epithelium which has a palisade arrangement at the base, above this many layers of oval, long tailed cells, which are uniform in size, shape, and staining characteristics. Toward the surface the cells become flattened and the most superficial are similar to the epithelium of the normal bladder mucosa. In the malignant papilloma the arrangement of the epithelium is changed and instead of being in regular uniform layers it is disordered. The individual cells are irregular in size and shape and take the stain with varying degrees of intensity. These variations from normal are even more evident in the nuclei. At times, owing to the lawless growth of the epithelium, the papillae fuse so that the regular papillary arrangement is destroyed. Not infrequently in the same field papillae can be seen undergoing various degrees of alteration. In one portion the epithelium may have all the characteristics of the benign papillae, but close by may be papillae in which epithelial changes characteristic of the malignant papilloma are very evident. Sometimes the malignant picture is best seen in sections from the surface, while sections from the middle of the tumor and base may be considered typically benign. At other times sections from the middle of the tumor or

portions near the base may show the most marked evidence of malignancy. The old view that the nature of the tumor is to be decided upon especially after examination of its base is distinctly erroneous. It has now been repeatedly proved that the base of a papilloma may show no signs of infiltration and still the tumor be distinctly malignant in its body and periphery. When infiltration of the base does occur, the tumor ceases to be a true papilloma and becomes rapidly sessile—a distinct papillary carcinoma. The diagnosis of a malignant papilloma is at times very simple, as the histological changes are characteristic of typical carcinoma, while at other times the histological picture as a whole resembles so closely the benign tumor that only a careful study, by an experienced pathologist, of numerous sections will reveal its true nature. Probably in no other tumor has so many mistakes been made by the best pathologists. It should be emphasized that in papillomata evidence of epithelial infiltration of the connective tissue stalks is not necessary for the diagnosis of malignancy and that every papillomata that shows the slightest change either in arrangement, shape, size or staining properties of the epithelium should be looked upon as malignant. It must be admitted however that there is no histological picture which can be considered as always absolutely characteristic of either benignancy or malignancy.

SUMMARY AND CONCLUSIONS

In only tumors which were papillomata has fulguration succeeded in destroying them, and it has been possible to destroy not only the benign but the malignant papillomata. The response to treatment, however, in the benign as compared with the malignant is of considerable interest. Where the tumors are cystoscopically and histologically benign the rapidity of disappearance is frequently

astonishing. When, however, the papillomata are malignant the response to fulguration may be extremely slow and lead almost to discouragement. Where the histological picture is distinctly malignant one can almost positively predict that the response to fulguration will be extremely slow. Sometimes small malignant papilloma will require many times the amount of treatment which would have been necessary to have destroyed a benign papilloma of the same size. In one case with multiple malignant papilloma covering the left lateral wall of the bladder and the tumors so fused at their surfaces that it seemed like one large tumor mass, seventy-five treatments, extending over a period of nine months, were necessary to entirely eradicate the neoplasms. The result in this case might be considered brilliant, because no radical operation could have given as complete a result. In the papillary carcinoma or sessile tumors, where infiltration of the base is always present, the chances of eradication of the tumor by this method of treatment are practically nil, although considerable symptomatic relief may at times be obtained.

From the standpoint of ultimate prognosis it is important to have a knowledge of the nature of the growth removed, because in three of our cases in which malignant papilloma had been successfully removed, death occurred later from metastases, although the bladder remained free of tumor. Furthermore recurrences have been encountered only in cases in which malignant papilloma had been removed. Up to the present time recurrences have been observed in four cases.

It can now be positively stated that fulguration should be the treatment selected for all papillomata, benign or malignant, in which infiltration of the bladder wall has not occurred, and that it yields results incomparably superior to the most radical operative procedures.

SURGERY OF THE URINARY BLADDER

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THE surgery of the bladder for new-growths is still in the period of development. This is demonstrated by the fact that there is no uniform method of interference, whether it be with radium, the X-ray, with the intravesical procedure with one of the many operative cystoscopes, or with the aid of the high-frequency current, or even whether it be with the scalpel. In this review I shall refer only briefly to all methods and attempt to outline what has been done up to the present time with the open cutting operation.

As a matter of historical interest, Warner, in 1747, through a lateral perineal incision operated successfully upon a tumor of the bladder. Previous to this time little had been done, and that only in a haphazard sort of way. Civiale recognized two kinds of tumors, carcinoma and fungus. He believed the latter more common, and noted that it occasionally became transformed into a cancerous growth. Civiale did not use the lateral perineal stone incision, which was practically the universal route up to that time not only for diagnostic purposes but for removal as well. He used an intravesical method employing an instrument like a lithotrite, which would grip the growth, and crush and tear and remove in the best possible way. To say the least it was rather crude, but from what I could infer his results were as satisfactory if not more so than those obtained through a perineal incision. Hutchinsson in 1857 reports median perineal incision and removal of growths from the bladder. Thompson used specially constructed forceps used through the urethra or even through the perineum. Simon as early as 1875 described a urethral specula for use in women by which he removed growths from the bladder. Kocher and Volkman used the speculum of Simon in the male, but performed external urethrotomy as a preliminary step. Thompson, Guyon, Antal, Mickulicz

and many others advanced methods all pertaining to interference through the perineum. In 1874 Billroth operated for a bladder tumor successfully from above. It remained, I believe, to Trendelenburg to describe in detail the *Beckenhochlagerung*, and the easy access to the bladder with this position. As to the route, incision through the vagina — colpocystostomy — was carried out more than twenty-five years ago. Yet Tamin in 1912 again advanced this method of approach. I believe the credit for the suprapubic method of approach to bladder tumors is due to Guyon. He did not devise it but insisted that it was the correct method. Partial and total resection of the pubic arch was suggested by Helferich, symphysiotomy in connection with bladder operations by Ferns, the lateral route by Levin as late as 1896. Franz was the first, if I am not mistaken, to advise the total removal of the bladder. Bardenheuer in 1887 was the first to carry out the operation — however, unsuccessfully. The following year Pawlik made a successful total cystectomy. Watson, of Boston, in 1905 took the advanced stand and proposed that it should be performed in all instances of cancer in which it is proper to do a radical operation, that is, in those cases where it is believed that the growth is confined to the bladder. Rydygier in 1888 advocated the intraperitoneal or abdominal mode of attack. Harrington in 1893 again brought this operation forward. Watson in 1905 revived the question, and in 1908 Mayo gave his experiences with this method of interference. Although my remarks are restricted in this symposium to "Operative Interference of the Bladder," it is necessary to refer in as few words as possible to the pathology, as well as the diagnosis, for full understanding as well as an appreciation of my attitude on this subject. Even in this era of modern cystoscopy one resorts to inspection, percussion, and auscultation for information as

regards resistance, size, and anomalies such as irregular shape, glandular involvement, etc. Bimanual palpation, particularly under anæsthesia, not often resorted to, with one or two fingers in rectum, and in women in the vagina, with other hand on the abdomen, gives information as to the involvement, that is, infiltration of the entire bladder, or, if only localized, a fair idea as to location and size. Soft tumors, large or small with no infiltration, cannot be palpated. Dilatation for palpation through the urethra of women as described by Simon, in the male by Thompson and Volkmann, is at the present time out of use.

With the examination of the urine and of particles of tumor passed with the urine, or gained, as originally advised by Kuster, with a spoonlike catheter, or with the rongeur, as advised by Young, or with any one of the operating cystoscopes, some information may be gained. Sounds or catheters are of no accurate diagnostic value. One instrument, the cystoscope, is absolutely essential and the most reliable instrument for purposes of diagnosis. It permits a thorough examination of the interior of the bladder, and allows in most instances the recognition of tumors, their number, size, and location. I do not wish to discuss the question whether or not it is within the power of the individual to differentiate the character of growths as seen through the cystoscope, but I know that the greater the experience of the cystoscopist, the greater the possibility of recognizing whether malignant or benignant as classified in the accepted manner of today. It is not incumbent on me to discuss the advantages or disadvantages or the use of different cystoscopes. Suffice to say that individual cases may often decide which instrument to use in order to overcome obstacles. A thorough diagnostician in this field cannot limit himself to one method of cystoscopy or to one kind of cystoscope.

In cases where it is impossible to apply this mode of cystoscopic examination, exploratory operations have been advised—needless to state, in cases of contracted, irritable bladders, or where hæmorrhage is of such severity as to prevent inspection. In taking up this

subject I realize that it would not be complete unless I insist on the necessity of taking all factors into consideration. I wish to refer to the question of considering the activity of the kidneys as well as the functioning capacity of the cardiovascular system, and of establishing in every known way the exact status of each individual. Where so many operations are necessarily carried out on the aged, I believe it is imperative to take advantage of every possible help. I believe that a medical examination of scrutinizing character should be made, including blood-pressure tests, hæmoglobin examination, white and red cell count, urine examination of every character, and all the methods which are peculiar to this field of work, cryoscopy of the blood, and all known functioning tests of the kidneys, and that all this mass of evidence should be carefully considered before deciding upon any operative step. It is needless to state that the general condition of the patient, or any individual factor which often plays a part, must be most carefully considered before discussing the question of the character of the operation, whether resection or excision, etc.

The anæsthetic is a matter of equal importance. It is not possible to discuss this question correctly unless all factors concerned are taken into consideration. I wish to state that it is desirable to consider scopolamine, morphine, nitrous oxide oxygen, intraspinal, subdural, local infiltration of various kinds, ether and chloroform anæsthesias, either singly or combined. The selection of the anæsthesia as well as the selection of the correct operative procedure has everything to do with the results, as regards freedom from recurrence, and even with the mortality, as shown by the great variation in the statistics at our command. In order to be guided correctly and not to be misled, it is the sound judgment of the surgeon rather than statistics, after taking all the foregoing into consideration, which will lead to the best results. *I earnestly believe and insist that every new-growth of the bladder must be considered a serious matter.* Although an occasional cure has resulted following spontaneous torsion of a pedicle, and a large num-

ber of so called benign tumors have been operated upon successfully, either intravesically or from above, without further tumors occurring, or recurrences at the site of the removal, or metastasis appearing in the individuals, still severe hemorrhage, no matter from what kind of growth, has often caused conditions of grave import. Also benign tumors have become malignant, and in other instances tumors of like character have been noted elsewhere in the bladder and regarded as implantations, or false recurrences, or malignant growths; and many cases of metastatic as well as true recurrences have been the cause of death, and also transplantation following the apparent removal, either by resection or excision, of malignant, and supposed benign, growths have been recorded. I wish to refer to the article by Schmidt on tumors of the bladder, which appeared in the *Transactions (1907) of the American Association of Genito-Urinary Surgeons*, which pertains to this topic.

I naturally cannot go as deeply into the subject of diagnosis as I should like, but I simply wish to state that according to the method of diagnosis and the competency in interpreting the findings the operative technique will vary. After considering all conditions one must decide first whether or not to operate, then as to exactly what should be done, and above all he must be able to give an accurate prognosis. To illustrate. Take into consideration a case where only an incomplete or poorly carried out cystoscopic examination has been made, or where only a clinical diagnosis, "tumor of the bladder," has been made and where the character, number, site, and extent of involvement is not known. How is it possible to proceed correctly? I assume the attitude, that in order to do a surgical operation expeditiously, accurately and correctly it is highly desirable to know for oneself all the facts before proceeding and not to be informed at the time of operation, as in some instances it might put the operator to great disadvantage and bad results might follow which might have been avoided had the operation been started with a full knowledge of the case. On the other hand, let one consider a case where all meth-

ods of diagnosis with which genito-urinary surgeons are familiar are employed, enumerating the more familiar and important. Cystoscopic examination, which informs one as to the probable character, site, and number of tumors, and allows portions of tumors readily to be removed for pathologic diagnostic purposes, X-ray examination of the air-filled and again with the collargol-filled bladder, the functional tests, as they are carried out in the various ways, of the urine and blood, and all the methods of examination already mentioned. Under these circumstances, with a full knowledge and appreciation of the facts, how is it possible to proceed incorrectly?

It is a fact that deliberate systematic operations for tumor of the bladder date back hardly twenty-five years. In the early days operative interference was carried out chiefly to relieve pain or stop hemorrhage. The patients as a rule were allowed to run along to a point where their general condition was so low as to permit nothing except the slightest interference. If the growth were permitted to continue, hemorrhage and sepsis and the results of backward pressure and infection, that is pyelonephritis, would occur. To permit such to occur at the present time would be nothing short of a crime. The first and correct course has been, since the newer methods of diagnosis have been at our command to elicit at once the cause of blood in the urine or pain in the genito-urinary tract, whether or not associated with the act of urination. Oftentimes infection, pus in the urine, may occur before blood appears. Hence the source must be looked for. It stands to reason that the operative treatment will vary with the findings. I do not wish to cite statistics, as these are often misleading but it is agreed by numerous authorities that operative results vary with the extent and method of operation. Also the earlier the diagnosis the more satisfactory the results. It is for this reason that I wish to point out what I consider the correct procedures for these cases which at best do not give perfect results. *I can state that fulguration of certain bladder tumors in my opinion, is the method of choice if the neo-*

plasm is considered benign and if the site is accessible to this mode of treatment There are, however, factors such as age and other conditions which might cause one to do an open operation

I shall not touch upon the indications and contra indications more than is necessary to make my position perfectly clear as regards the open operative treatment. Clinical as well as experimental work has demonstrated the fact that it is safe to permit sterile urine to enter the peritoneal cavity. Ruptured bladders with urine in the peritoneal cavity for hours have frequently been noted, and recovery has followed operation. Again, every operator has entered the peritoneal cavity either deliberately or accidentally in cases of both sterile and infected bladders and no harm has been noted. But I certainly wish to be put on record that I have seen, in my own as well as in the work of others, cases of peritonitis and death following the deliberate as well as the accidental entrance of urine into the peritoneal cavity during the operation of an infected bladder. For this reason I cannot permit to go unchallenged the statement that no harm results from the transperitoneal operation, and hence this operation should be advised as the one of choice simply because it makes the tumor more accessible.

Not considering intravesical methods of operation, there are only four avenues of approach: the perineal, the paraarectal, the vaginal and the suprapubic. All but the latter are obsolete in the light of every precept of modern surgery. However, where the removal of part of the bladder, if involved secondarily from a growth of the uterus, a vaginal or combined operation may necessarily be considered. Admitting that there may be rare instances where it might be desirable to enter the bladder through the vaginal, parasacral, or perineal route, it will be from my point of view best to omit discussion, and I gladly refer those interested to the literature. This review has chiefly to do with primary growths of the bladder and hence procedures involving parts such as the uterus, prostate, and bladder secondarily are only touched upon.

This brings the matter up to the suprapubic route, whether it be by the intraperitoneal or extraperitoneal method. As a matter of fact, one and the same principles of surgery apply to both, and for this reason I believe it desirable to consider points that are common to both. For many years there was scarcely any objection to the median-line incision of the skin and the subsequent separation of the muscles parallel to their fibers. The length of incision for thorough exposure is one of importance. The incision which is inadequate for thorough and easy access is to be condemned. In recent years the transverse and semilunar skin incision has been advanced. This permits of the separation of the muscles or the dividing of their attachments to the symphysis and allows operative interference on the pubic arch, as advised by Albarran. Personally I have never seen the necessity for nor any advantages from this incision, and cannot advise its general use, admitting that such an indication as pyelocystitis of the urinary bladder might make it worth considering. Transverse incision of the bladder itself has been advocated. I can see no advantage over the usual incision. The bladder can be incised in any direction without any detrimental effects.

Next in order is the question of the dilatation of the bladder as a preliminary step to the operation. Is it to be filled with sterile air or fluid? No bladder if infected at the time of operation can be freed from infectious material by irrigations or the use of antiseptic fluids. For this reason it has been advised to fill the bladder with air so that at the time of opening it there can be no escape of fluid which might carry contamination. It would only be necessary to care for the urine secreted between emptying the bladder and the opening of the same. In certain types of infection and in cases of intraperitoneal operations this step should be seriously considered for reasons already mentioned. It must be admitted that fluid will carry infection to every part and in cases of extraperitoneal loosening of the entire bladder from its natural attachments, an enormous exposure is created and the

parts bathed in fluid carrying germs of infection. The bugaboo of peritonitis and urinary infiltration still pervades the minds of some and causes hesitation as to the best course to take. Unquestionably it is desirable to consider what has already been stated in regard to the preparation of the bladder. Certain consideration must be given to removing as much debris as the naked eye will permit, and the use of antiseptic fluids which retard or even destroy the bacterial growths which come in contact with the same is to be recommended. In instances where it is deemed best to avoid entrance into the bladder and peritoneal cavity at the time, there has been advised by Mickulicz, and frequently carried out by myself, the transverse incision of the peritoneum at the point of the attachment of the bladder before entering the bladder, and suturing the same to a point or line of the bladder wall sufficiently distant to permit extraperitoneal work on the bladder, yet with the bladder-wall covered with the peritoneum. In those cases where the tumor is so situated and where it is also considered best not to perform an intra abdominal operation, I consider it a justifiable procedure. It is within the laws of surgery and certainly is an acceptable step, provided the location of the neoplasm is thoroughly understood before commencing the operation. I have always stated that before proceeding or contemplating a bladder operation for tumor, the operator should be thoroughly informed on every point. If this is the case this little point may be of great value in certain selected cases. The fear of urinary infiltration was such that the suprapubic route was not even considered with great favor, although Guyon insisted that it was, even with the drawbacks of the surgical technique of his time, the route of choice.

To overcome the infection of the prevesical space and so called urinary infiltration, many questions of importance have arisen as to the best course to pursue, whether or not complete closure of the bladder, implying the question of drainage, suturing of the bladder to the abdominal wall, drainage of the spaces suturing of abdominal wall and method of closure

of the skin incision, use of a permanent catheter or regular catheterization in order to keep the bladder free from urine and avoid overdistention of the bladder, the question of suture material and the method of employment as regards the stitch, and many other points of vast importance to the welfare of the patients. In reviewing his results von Fritsch regretted that he had attempted to close the bladder, although he did so only in clean cases and excisions of small tumors. Kolischer and Schmidt, 1907, advised against the use of permanent catheter and drainage, depending on spontaneous urination or regular catheterization. Mayo, 1908, has also taken this course. In following this procedure I can only insist that careful watching is desirable, and that catheterization must be carried out according to the demands of the individual case, if this is not done drainage must be considered, and I believe this was the cause of the bad results recorded by von Fritsch. If bladder drainage is instituted, questions of minor importance arise, as to whether interrupted suture or purse-string suture are to be used, also as to whether or not the drain is to be sewed to the bladder. This should be done with fine, readily absorbable interrupted catgut, the suture not taking in the mucosa. This question does not entirely, except in some instances, depend on whether or not infection is present. Of all cases examined cystoscopically after operation I have never had any reason to regret this procedure. In large resections I have frequently taken all coats but do not deem it absolutely necessary. Mayo and Judd use for closure of the bladder wound a running or mattress suture, as advised by Connell, reinforced with silk or linen, and using the Cushing parallel peritoneal stitch. O'Neil uses catgut and closes in two layers. Kolischer and Schmidt 1907, discussed this question and advised that all coats be included, in smaller incision, however, this is not necessary. Even kangaroo tendon has been advised for bladder work. I cannot see the necessity for using chromic catgut. This has been my personal experience on a large series of cases. If not through all layers one may avoid stone or incrustations. Too

quick absorption has been put down as permitting secondary hemorrhages. In order to overcome the spaces above and below the line of incision, if latter is in median line of bladder, sutures can be applied through the bladder as if closing the bladder in stages and bringing to the abdominal fascia, thus obliterating these spaces. This can even be done in those cases where the opening of the bladder is on a lateral surface, yet the suturing of the bladder can be made in the median line to the abdominal wall. To avoid unnecessary spaces and to lessen the area of infection I consider it a good procedure not to strip or loosen all the prevesical fat but to incise it at the time of opening the bladder, and to permit it to remain undisturbed. I cannot insist too strongly on this point. To strip off the peritoneum from the bladder is a different matter and must be done if some of the operative procedures to be suggested are to be carried out. Rubber tubing may be placed under the symphysis or at the lower angle of incision, or, again, a small drain to the lower point of the incision, which may be on the posterior surface of the bladder or on either side if the entire bladder is enucleated as advised by Squier. In the intra-abdominal operation Mayo has advised the drainage of the peritoneal cavity in certain cases. If necessary to drain the bladder I have never had occasion to regret the use of glass drains. On removal, the slough which is always present with the use of rubber tubes is entirely avoided. Personally I have not found it advantageous, if drainage is used, to advise any of the different forms of apparatus devised for drainage. The simple syphon has given satisfaction.

Before taking up the subject in detail I wish to refer to some facts bearing on the subject which have a deciding influence. Lymphatics of the bladder are comparatively few and inactive. This being true, metastasis is delayed, and for this reason a malignant tumor, at least in its incipency, may be regarded as a local condition and curable by resection, particularly so if all coats of the bladder and adherent tissue be removed *en masse*. Zuckerkandl, Harris, Rovsing, Schmidt, all agree that three-fourths or more

of the bladder may be removed and a good functioning bladder result. My personal observation, ten years after operation following excision, except for trigone and internal urethral orifice, shows a bladder which is in no way different from a normal bladder. Watson has removed the unopened bladder and used the intra-abdominal route. Mayo, Casper, and others believe that if the operative field is not sufficiently large, neoplastic tissue can easily be transplanted into abdominal wall or space of Rutzus. Personally I know of several cases of this kind. Even with good exposure this is possible and hence it has been advised to scar with the thermocautery the surface of the tumor, or treat it otherwise to prevent this occurrence. Cup-like forceps, devised by Zuckerkandl to grasp and enclose the tumor, have been used to prevent contact with surrounding tissue in order to avoid this transplantation.

It must be admitted that there are many failures in the surgical treatment of tumors of the bladder. I have already discussed the tendency of tumors to change character, and also their tendency to recur, whether true or false in character. But there are other causes of recurrence than incomplete removal, and I agree with Squier that an operation performed on a patient who has not been thoroughly examined is not satisfactory. If the bladder is not sufficiently exposed to permit of accurate work then not only the attached tumor with surrounding healthy tissue is not removed, but metastatic or transplanted tumors elsewhere in the bladder are overlooked. Besides, without a thorough previous understanding many operations are commenced and one finds himself unable to perform a radical operation if it is deemed necessary.

There are practically only two types of operations.

- 1 Palliative—
 - a Cystotomy.
 - b Exclusion of the bladder
- 2 Radical—
 - a To excise or resect
 - b Total cystectomy

In excision or resection the flow of urine is not deviated even if there is transplanta-

tion of ureter in some other part of the bladder, but if total cystectomy is considered, the urinary flow from both kidneys must be deflected as a preliminary step, later followed by cystectomy. However, removal of the bladder has followed in some instances at one and the same time. I do not hesitate to state most emphatically that experience is lacking with many surgeons as regards the operative interference on the bladder, and I must admit that the sum total of recorded cases of some of the operations advised is rather limited, besides, the results shown are not of such astonishing nature, and it requires great courage of conviction to insist upon and to carry out certain procedures which up to the present time are condemned without sufficient reason. The future holds in store the proof as to whether or not the operations which are carried out only occasionally at the present time are worthy of greater use. To illustrate this point, most continental surgeons agree that malignant involvement of any portion of the trigone, internal urethral orifice and prostate, contraindicates any operative attempt at resection or extirpation of the bladder. Up to the present time there is no definite understanding as to the selection of cases for resection, as there are those that believe that any malignant growth excludes the possibility of radical removal except by total cystectomy. On the other hand, there still is some discussion as to the best procedure in cases regarded as benign papillomata, although other than papillomatous tumors of benign character are often removed. To complicate matters, there are many who advance the idea that no tumors of the bladder are clinically benign. As to whether excision is to be preferred to high frequency apparently in the past few years the latter has been preferred in cases of papillomata. I cannot permit sufferers belonging to the class involving trigone, etc., to gradually become worse. The questions of extent, and character of growth certainly should be taken into consideration. The continental surgeons probably would wait for the opportune time to do simply a suprapubic cystotomy. But if one or both urethral orifices were being oc-

cluded, why not consider diversion of the urinary stream, at least even if no cystectomy could be carried out? And in the case of the neck of the bladder being involved, why not attempt Young's operation or some modification as a radical cure, at least in the incipient cases, even if cystectomy is considered contraindicated? This topic bears directly on the operations for cancer of the prostate gland. Several well known operators previous to 1900 — Kuster, Fuller and Laisrunk — removed glands, vesicles, and the neck of the bladder. In 1904, Young brought the entire matter up again and I believe it is worthy of consideration.

Without too great detail the operative technique of Young's operation is as follows:

(1) The bladder is thoroughly irrigated and emptied. (2) The patient is placed in the exaggerated lithotomy position. (3) The field of operation is prepared. (4, 5, and 6) An inverted V incision and dissection exposes the bulb and central tendon. The latter is cut, and the muscle is exposed and the rectum is separated from the urethra, prostate, and seminal vesicles. A sound is placed in position. An incision is made into the membranous urethra, Young's tractor is introduced and transverse section of membranous urethra is made in front of the tractor. Then with traction the puboprostatic ligament is exposed and divided, permitting an easy sweep around the prostate and neck of the bladder. With traction, the loosened structures are easily brought down. Now an incision is made on either side, in front of the urethral orifices. The vasa deferentia are pulled down, tied off and cut across. This permits the seminal vesicles to be brought down, and the entire mass with adherent tissue is removed. (7 and 8) Then the vesical opening is anastomosed with the membranous urethra and the floor of the bladder is closed. (9) The bladder is drained per catheter, the spaces per perineum.

In regard to malignant tumors of the bladder, and I fully understand the possibility of mistaking the character of so called benign tumors at time of operation, it will be well, after exposing the bladder, to palpate the base and surrounding healthy tissue,

and to explore within, after opening the bladder, before deciding the question of resection. I assume the attitude that whenever it is possible to outline with ease and accuracy the parts involved, even if involvement includes the ureteral orifices, it is justifiable to resect the healthy tissue outside the tumor 2 or 3 cm. If the ureteral orifice is involved, resection of it with neoplasm can be made in the classic manner. If this is done ureteral implantation into a healthy portion of the bladder necessarily follows. I firmly believe that the results warrant the procedure and hence do not advise diversion of the urinary stream and cystectomy in these cases. A recurrence may again call for further resection, or operation including diversion of the urine and cystectomy. As it is quite certain that in at least a limited number of so-called benign papillomata, the pedicle has been known to infiltrate the bladder-wall, the question of resection instead of excising has frequently been brought forward. Personally I have done so in cases of long standing, always if there was doubt as to the character, and believe that it is well to do so. Naturally where there are numerous tumors distributed over the entire inner surface this cannot be done. However, I have made a resection where there were 25 or 30 small benign tumors in an area of about 6 cm in either direction. In cases of papillomata in and about the ureteral orifices, preliminary ureteral catheterization should always be carried out. Resection of the bladder-wall or excision of the tumor is greatly simplified by this procedure.

In the last few years the high frequency mode of treatment has apparently given universally good results and I have about fifty cases of my own. As this subject is to be thoroughly reviewed by others I merely take this opportunity to insist that it is the most suitable mode of treatment. To neglect it is a surgical error, unless there be some definite reasons, such as hemorrhage, size of the tumor or its location, which are scarcely possible, for its contra-indication.

In this outline I have no pet theories or special operations to advance and hope that my experience has permitted me to select

the best that has appeared in the literature on this subject.

In taking up the palliative operations, how is it possible to select the cases correctly? I need not state that it frequently becomes necessary to do so for other than surgical reasons. This matter cannot be discussed. If an individual shows signs of cachexia or if metastatic conditions are present, or if loss of blood from ulceration of the bladder tumor, or again if pain is excessive as when the internal orifice is involved, it is justifiable to perform the suprapubic operation in the ordinary fashion and remove with curette and scissors or otherwise, and cauterize with thermocautery, "spark" with the high frequency current, or "bake" with diathermy, the parts involved. It is needless to state that these cases demand the establishment of a permanent outlet for the flow of urine. This treatment may be carried out from time to time as found necessary. It also demands the wearing of a urinal. Naturally the question of X-ray therapy and radium or mesothorium treatment is of special interest at this point. However, the question will arise, why use this mode of treatment in these advanced cases only? I believe this can be readily answered at the present time. Neither the modern X-ray treatment for deep-seated growths nor the application of radium for growths involving the bladder, have as yet been sufficiently tried out to prove them of sufficient value to replace other surgical procedures. However, it must be understood that either or both, if carried out according to the precepts already known, may be used to advantage. I certainly do not believe it wise to rely entirely on one or both, but I have knowledge of one case which has been, to all cystoscopic and other evidence, freed from malignant growth. I must insist in the present state of our knowledge, that it certainly is advisable, I might even state correct, to treat all cases before and after operation, and all cases not operated upon, with the X-ray. I do not feel quite certain as to radium or mesothorium therapy. It remains to be proved whether it is good practice in cases which have been operated upon and apparently not freed from the growth

But for the advanced cases it certainly must be taken into consideration, as urinary fistulæ do not give the necessary relief. I believe, if no contra-indications of a grave character are present, that exclusion of the bladder should be seriously considered. It is a well-known fact that in cases of tumor of the bladder of malignant character not showing cachexia or metastasis that simple curettage of the portion involved has apparently resulted in a cure. But on the other hand many ill results, such as urosepsis, have frequently followed. It is true that sparking with high frequency current probably will avoid these untoward results. But diathermic treatment, as it is carried out at the present time, unquestionably is the method of choice, and should be preferred rather than simple curettage and simple cauterization or use of the ordinary high-frequency current. I have had experience with the modern methods of treatment and refer to them from this standpoint, not simply from a theoretical view. Whenever one or both ureteral orifices become involved to such an extent as to cause damage to one or both kidneys, or whenever the establishment of a simple urinary fistula cannot or does not give the necessary relief, I believe, if no contra-indication of a grave character is present, *that exclusion of the bladder should be seriously considered*. Up to the present I have not been convinced, and I must admit that I may be acting incorrectly, that according to some authorities the right procedure is, as soon as a diagnosis of malignant growth of the bladder is made, to advise and to carry out diversion of the urinary stream and removal of the entire bladder. To take this attitude, with the knowledge of the results of treatment of so called benign papillomata, and the results of carefully carried out resection of the bladder, is a step a little bit too advanced for me to assume.

At this point I wish to call attention to direct transfusion in cases of long standing hæmorrhage, particularly if the result of a benign tumor, and also as a preliminary step to operation in cases of malignancy. Leepinasse has seen good results following this procedure. I believe the usefulness of the

operation, meaning the benefit which it offers, has as yet not been proved.

"Palliative exclusion" has not been sufficiently tried out in connection with malignant tumors of the bladder, but I am convinced that it will be given further attention as the subject of tumors of the bladder is better understood. I mean by this term, exclusion of the bladder, nothing more or less than the diversion of the urinary stream from the bladder. In reviewing the literature on the subject, I believe that Maydl's operation for extrophy of the bladder was what gave origin to the thought in connection with the subject under discussion. I can readily believe that if a patient possesses control of micturition, even though it be through the rectum, it gives considerable satisfaction. Incontinence, even if the wearing of a urinal keeps the patient dry, is the cause of depression and despondency. If there were no disadvantages to the former, I do not doubt that it would be the method of choice. But many questions of great moment arise, the paramount one being where to direct the stream. If to the back, with aid of ureteral fixation to loin with double nephrostomies, incontinence is present and requires constant care and carrying of urinals. This subject has been thoroughly discussed by Watson, and recently Peterkin has urged this course. However, I am inclined to believe that if it were possible without fear of ill results to lead the urine to the bowel it would be desirable, as then it could be readily evacuated. Under the circumstances it probably will be best if I do not discuss the subject in too great detail, as to where the transplantation or anastomosis is to be made, whether high in the large intestine, or in an excluded portion of the sigmoid or rectum, or whether to create a new bladder. It is a matter of such importance that the danger, disadvantages, and discomforts must be considered before carrying out the diversion of the urinary stream if led to the bowel, then in such manner that it can be easily evacuated, if to the sigmoid, this usually becomes impacted with faeces and makes this site objectionable. Whenever implantations of ureters are made into the bowel it must be admitted that as-

cending infections of the kidney are the rule. If this could be overcome it would be the course of preference. If to the skin, urinals must be worn. These are often times unbearable and besides do not always keep the patient dry. The urine is often the cause of severe inflammatory reactions in the skin. These fistula permit incontinence, which fact is often depressing to the patient. Infection of the kidney following this procedure are not so common, and from this point of view, considering length of life particularly, it is to be preferred. Besides, when considering all, the operation is accomplished without much danger and hence may be more desirable chiefly in cases of lessened general resistance.

Undoubtedly if palliative cystotomy gives no relief, and if it is possible to prolong life and free the patient from pain, deviation of the urine must be considered. It is needless to state that cystectomy need not be advised except in selected cases, and then it makes the operation a radical operation for the removal of the tumor.

Before taking up the subject of resection of the bladder, I believe in order to round out this subject that it is advisable for me at least to mention the Hiltz-Boyer-Havelock operation for the creation of a new bladder. It is divided into stages.

(1) Abdominal dilatation of the anus median umbilical incision exposure of the colon, and the rectal ampulla dilated. (2) Section of the large intestine as well as adjacent peritoneum the two ends temporarily closed by purse-string sutures. The rectal ampulla is pushed forward. The closure of the lower end of intestine is completed. The retrorectal space as far as the tip of coccyx is dug out. The rectum which becomes a bladder is closed by a peritoneal row of sutures. (3) Of the two ureters the left is implanted in the new bladder the implantation being hidden by a peritoneal fold the right implanted in a similar manner, if possible, or according to the method of Payne. (4) Finally, the superior colic end is invaginated into the "dug out" retrorectal space, the pelvic and iliac colons having been brought down to their utmost, and then

closure. (5) Perineal step, through the retro-anal incision following the posterior face of the rectum there is done a transverse fluting for a little less than half the circumference of the gut, in the posterior portion. The superior colic extremity has been drawn up. The colic extremity is invaginated. The operation may thereby be described as under one for continence of the urine. This is assured by the anorectal sphincter. The end result gives two new conduits, one fecal, the anus being the end of the intestinal tube, the other urinary, with new ureters ending in a created bladder.

At the present time the limit of resection depends entirely on the view of the operator. I hope that I have made myself clear on this subject, as I have already discussed the different aspects. There are statistics that are misleading. But why refer to statistics? They are and always have been used to deceive. If they support the views advanced they are quickly used if they do not they are adroitly omitted. Even statements of individuals can be used in the same manner. I do believe, however, that it is possible to place great weight on statements and facts, particularly if advanced by operators of known ability and veracity. Extensive resections of the bladder are performed with increasing frequency and probably the results are better than formerly where boldness was lacking. I must admit even where generous removal of the tumor in surrounding tissue which is apparently healthy has been done, that the question of the surgery of known malignant tumors has as yet not been settled by any means. I can only review my own cases, see the good and bad and analyze the results and note the reasons thereof. In a large number of cases I can readily see the error of my ways. Take for instance growths of long standing known possibly by their hemorrhages even if favorably located which terminate as a rule unfavorably. Even if all the adherent tissue and, if present retroperitoneal glands be removed *en masse*. I doubt whether one could expect a permanent freedom of recurrence and metastasis. It is in these cases as well as those where tumors are unfavorably located that

diversion of the urinary stream and cystectomy will have to be considered. There are surgeons of known thoroughness and ability who do not even recognize any possibility of success, no matter how extensive a resection be made, but at once urge diversion of the urinary stream and cystectomy. Permit me to outline in a general manner various operative interference, the choice of which for the present must remain with the surgeon. Needless to state, one should carefully consider the advantages and disadvantages before proceeding with the individual case under consideration.

I shall briefly state the mode of procedure in the abdominal or transperitoneal method of operation.

STEPS OF THE OPERATION

The steps of the operation are: (1) The bladder is thoroughly irrigated and emptied. (2) The patient is placed in the Trendelenburg position. (3) The field of operation is prepared. (4) An incision is made in median line from pubes upward above and to the left of the umbilicus or higher if necessary, not entering the peritoneal cavity, however. (5) The prevesical fat is gently pushed aside and it is in my opinion, desirable not to disturb the fat more than is necessary. Depending on the location of the vesical tumor the question of extent of stripping the peritoneum will arise. If the tumor is only on the lateral wall the midline attachment of the peritoneum to the bladder may be allowed to remain undisturbed and the lateral corresponding half of the bladder can practically be enucleated with the greatest ease. If the growth is situated more in the median line the lateral spaces can be left practically undisturbed. If, however, the tumor is in the median line on the posterior wall, it may be necessary to enucleate the entire bladder except for its attachments at the pubic arch. (6) With the tenaculum forceps the bladder is picked up and is opened at the desired point, etc., as per sixth step, in description of the transperitoneal operation. (7) Closure of the bladder wall. (8) Closure of abdomen. (9) Post-operative treatment.

In connection with this operation many

details have already been discussed in a previous part of the paper, but I wish to refer particularly to some others. It is to be thoroughly understood at the outset that thorough exposure is desirable; that whenever there is the slightest question of involvement or adherency of the tumor to the peritoneum, it is to remain undisturbed and the transperitoneal operation added, or, if it is possible after the peritoneum has been opened transversely anterior to the growth, to bring the free portion of the peritoneum which lies anterior to a point some distance posterior to the adherent peritoneum and then suture these together. This makes the involved area covered with a layer of peritoneum an extra peritoneal operative condition, in other words, making a simple "exclusion" of the bladder-wall involved. This in turn again permits one, if the bladder has not been opened, to proceed in the manner as already described. I wish to state that it is well not to distend the bladder too much. If overdistended stripping becomes dangerous and damage to the bladder-wall may result, or one enters the bladder at a time when it is not desirable. There are numerous steps recommended and known by personal experience that can be used in selected cases. It will be well to mention them. Proust advised if the growth is so located in the vertex or even on the lateral wall that the area involved can be easily palpated from the outside, that curved forceps be applied some distance from the growth to both external surfaces of the bladder, and in this manner remove without opening the bladder. Then with appropriate suture, close with one or several layers. This avoids to some extent the transplantation of the tumor by any unnecessary handling. It is a clean and satisfactory method in selected cases. Hagner locates the neoplasm cystoscopically and while the cystoscope illuminates, sutures are placed at sufficient distance from the growth so that incision can be made without the unnecessary cutting of the bladder. Kolischer and Schmidt, in 1906, recommended cystoscopic examination in order to locate the growth as accurately as possible, and then to make the initial bladder incision a suf-

sufficient distance from the growth, and next by palpation to resect according to the needs. They also advised the closure of the bladder. This does away, as does also the Hagner method, with the usual incision of the bladder in the median line, which, needless to state, is entirely unnecessary in the class of cases where these methods can be instituted. It certainly is desirable to do away with any unnecessary incisions, in fact, the results are better. After resection of the bladder, even if extensive, the question often will arise in case of recurrence whether or not a further resection is advisable, whether deviation of the urinary stream and cystectomy are in line, or whether it is advisable to wait and do an old-time palliative suprapubic cystotomy. I believe, and in order to emphasize, I repeat that the extent of a resection depends on the individual viewpoint and experience of the surgeon. For this reason I do not advise total excision of the bladder when a growth is favorably located, but the question as to why not do so as soon as a malignant growth has been established, becomes more and more apparent. I have refrained from using statistics, as I believe that they are not a fair weapon to decide this momentous question. At this place I believe it desirable to make clear a few facts having a bearing on papillomata of the bladder. Although subscribing to the belief that all growths of the bladder have a potentiality to malignancy, I cannot agree with some authorities in treating all bladders involved with this character of growth by either resection or cystectomy. I have already insisted that all growths belonging to this type should be treated with the high-frequency current. If too large, and this is not a positive contra indication, or if hæmorrhage, or some condition exists such as contracture or irritability of the bladder, or if the location is accessible, is it justifiable to operate? Under these circumstances it is unquestionably imperative to remove them, but the question will arise whether by resection or excision. I may be taking a backward step, but I still believe that with a simple but thorough excision of the base, the terminal results are satisfactory. I appreciate the fact that Lichtenstern at Zucker-

landl's clinic has shown a malignant growth at the site of excision of a benign papilloma. Also that a certain number of tumors having all the clinical appearances of a benign tumor are actually malignant. This has been repeatedly shown by pathologists to be a fact. Right at this point the question of removing pieces by intravesical methods for diagnostic purpose comes up. I am not an advocate of this, for the question of cases of doubt can rarely ever be decided in this way. I believe that the base of the tumor as a rule is necessary in order to show the presence or absence of signs of malignancy, and that malignancy does not commence at the periphery whence the parts are obtained by intravesical methods for examination. To be more explicit the steps of the operation are:

The first, second and third steps are the same as in the previously described operations. The fourth is the same as in the extraperitoneal operation. (5) Without loosening the attached fat, sometimes pushing upward the peritoneal fold in order to permit of a good liberal incision into the bladder, pick up the bladder with a tenaculum or with heavy silk suture at the angle of peritoneal attachment, draw the bladder upward and forward and incise the fat which has been left undisturbed on it. At the same time carry the incision downward toward the pubes without withdrawing the scalpel until the incision is of sufficient size to admit easily tractors of varying size and shape.

Naturally all swabbing, protection of abdominal wound with pads, and other details sufficiently described and known are in order. Forceps devised by Zuckerlandl, which are spoon-shaped, in order to enclose the entire growth and prevent transplantation, may be useful in individual cases. The kind of tractor to be used, whether wide or narrow, long or short, whether one above or below, or two at either end, or upper external angles, will depend on the individual and on the location of the growth. Elaborate and self-retaining retractors for bladder work may be all right in the hands of some, or even in certain cases might be of help, yet one can get along nicely without them. The object of retractors is to make the growths easily

accessible I do not as a rule resect the bladder for true papillomata. However, I have already advised where numerous growths are within a certain area that the procedure of resection should be the same as in the cases of malignancy. In many cases the growths are located at or near the ureteral orifices, and it is good practice to catheterize the ureter corresponding to the side involved, before commencing the operation, in order to facilitate the surgical procedure which is found desirable after the bladder has been opened. I believe in a thorough excision. The more pronounced the pedicle the more liberal the distance from the pedicle is the incision made. If any induration is apparent at the base or there is any reason to believe malignancy present one should resort to a resection, even if it necessitates resection of ureteral orifice and implantation of the ureter. I firmly believe that after the incision through the mucous and muscular wall with scalpel or appropriate scissors the edges should be united with catgut and hæmorrhage stopped in this manner. As a rule I do not use the thermo-cautery or diathermic current to stop the bleeding, nor after or before suturing or cauterization do I advise "sparking." I believe that this is an admission of incomplete excision or resection. If it were to do any good in a malignant condition it would have to be done with such intensity that a certain amount of sloughing would result and produce complications.

The remaining steps are the same as in the previously outlined operations. The conditions which arise have already been discussed elsewhere and all these vary with the exigencies of the case.

Under radical operations (No. 2, type b) I wish to discuss total cystectomy.

I have repeatedly stated that there is at the present time no standardization of cases permitting one immediately to advise this procedure for certain cases. I must admit again that the operation will probably only grow slowly in favor until more definite ideas as to the true value of all the aforementioned operative procedures have been definitely shown to be wrong. On the other

hand I hardly believe that it will be forgotten, for there are certainly individual cases where it will always be admissible. But it is here that the argument of early operation can be brought to the fore at the present time by the advocates. Why use or commend it as a last resort in cases already known to be beyond operative help? It is right in this large and dangerous group where one will probably be obliged in the near future to decide in its favor. For the present I am not convinced that incipient easily accessible malignant growths or any apparently benign growths demand this procedure. And in the somewhat advanced cases can the length of life be increased or the comfort of the patient be made more certain? These are again questions which the future must clear up. The operation for total extirpation of the bladder must necessarily be divided into two steps. The first which has already been discussed under the palliative operations, consists of directing the urinary stream. The second part or cystectomy which follows immediately, if the condition of the patient permits or may be carried out at a later period if considered desirable may be made in the following steps.

The first, second and third steps, are the same as in the transperitoneal or extraperitoneal operations for resection of the bladder. The fifth step depends on the fourth. If the transperitoneal operation is done, walloff of the intestines, etc. should be practiced, if extraperitoneal then the bladder should be completely enucleated from all of its pelvic attachments. There is a difference here in the male and female as regards further surgical procedure. Pawlick in 1888 did the first total cystectomy on a woman and it is worth stating that the ureters in this case were implanted in the vagina. After removal of the bladder the anterior portion of the end of the urethra was sutured with the posterior wall of the vagina practically making a bladder out of the vagina. (6) In Pawlick's case the bladder was enucleated from above the anterior vaginal wall was then incised and the bladder drawn through and cut across just above its outlet at the beginning of the urethra and removed.

In the male as well as in the female extra-peritoneal enucleation is to be preferred. Naturally if the growth be somewhat advanced and the peritoneum attached to the bladder-wall, the operation becomes an intra-peritoneal one. In the first step the ureters have already been tied off with two ligatures, each as far distant from the bladder as is possible, and cut across between the ligatures. Now continue the enucleation of the bladder with the attached seminal vesicles and prostate, meanwhile having tied off both cords. The prostate and vesicles are easily separated from the rectum. A median perineal incision is then made and the bladder with attached vesicles and prostate are drawn through the opening and the membranous urethra tied in two places and severed between, permitting complete removal of all parts intact. It is naturally desirable to empty the bladder before bringing the parts out through the perineal opening. (7) Closure of the peritoneal cavity. (8) Closure of abdomen. Drainage of the space through the perineal opening. (9) No catheterization is necessary unless an artificial bladder has been established, as in Pawlik's case.

Since the time of Bardenhauer, who first carried out total cystectomy, many changes have taken place. Naturally, the question arises in the first step of what to do with the ureters so as to cause diversion of the urinary stream? In the second step whether or not transverse abdominal incision permits better exposure? Whether intraperitoneal proced-

ures are necessary in order to better remove glands if involved? Whether symphysiotomy or resection of the pubic arch is desirable, whether combined suprapubic and perineal operations are to be considered? The handling of the attached portions of the ureter, the question of removal of the vesicles, of the prostate, and even of both cords with the testicles, have all been more or less discussed and proposed by various writers. Watson, who has taken such a prominent stand for this operation, lifts the bladder high out of the abdominal wound and passes a double ligature through the median line of the posterior surface at the lowest part of the neck, letting the needle emerge through the anterior wall at a corresponding point, and then ligates the neck of the bladder in two halves and divides the bladder by a transverse incision. He advises a counter drain through the perineum and complete closure of the abdominal wall. He states that if the vesicles are involved they should be removed. The cords must be ligated, preferably near the inguinal ring, and removed. He further states that the prostate can be removed with the bladder by simply changing the site of the ligatures from the neck of the bladder to the urethra at the apex of the prostate and tying again each half as previously described. I personally have always carried out, and see no reason why it should not always be done, removal of vesicles and prostate. I believe it to be imperative to remove all *en masse* with adherent fat and tissue.

THE DESICCATION TREATMENT OF BLADDER TUMORS

BY EDWARD L. KEYES, JR., M.D., F.A.C.S., NEW YORK

THE desiccation treatment of bladder tumors consists in the application of the high-frequency electric current to the bladder tumor by means of an insulated wire introduced through the cystoscope.

The method was introduced by Edwin Beer,¹ in 1910. He employed the monopolar, or Oudin current, in essentially the same manner as it is used at present. In the same year I employed the bipolar, or d'Arsonval current,² but subsequently abandoned this in favor of the Oudin current.

Before proceeding to a description of the treatment and its results, let us briefly discuss.

1. The employment of the high frequency current in preference to the thermocautery during suprapubic operation.

2. The relative advantage of the monopolar and bipolar currents.

HIGH-FREQUENCY CURRENTS WITH SURGICAL OPERATION

Since its introduction this method of treatment has been employed either for the removal of tumors or the destruction of their bases during suprapubic operation. Perhaps there is some real advantage in this, perhaps it is simply a matter of convenience. Sufficient clinical evidence has not yet accumulated to permit us to decide the point. I fancy the actual cautery is all we need.

RELATIVE MERITS OF SINGLE AND BIPOLAR CURRENTS

But the Paquelin cautery cannot be employed through the urethra, even the electrocautery used by Nietze was a relatively clumsy instrument. To all intents and purposes the high frequency current introduced through the cystoscope merely gives us a practical means of burning bladder tumors.

The effect of the monopolar current is a

relatively superficial desiccation, or electrocoagulation, while that of the bipolar current is a deep baking or thermopenetration. At most the monopolar current can cause nothing more than a relatively localized burn, while the bipolar current, if used in sufficient strength, can destroy the vitality of almost any extent of tissue. This well-known fact constitutes both the danger and the seduction of the bipolar current. Many operators hope by its use to destroy even the carcinomatous base of a papillary bladder tumor. But the clinical experience thus far accumulated impresses one with the conclusion that a vicious malignant bladder tumor, however small it be, cannot be controlled by electricity in any form. It is only tumors of relatively slight malignancy that can be successfully treated by electrocauterization, and for these the monopolar current is quite sufficient and safer. Its action may be better controlled, the danger from grave hemorrhage following its use is probably less.

WHAT TUMORS ARE SUITABLE FOR CYSTOSCOPIC DESICCATION

Pathologists are no more agreed than ever they were in the classification of tumors of the bladder. Instances of contrary diagnoses multiply. In such cases a competent pathologist examines a tumor removed suprapubically and pronounces it carcinoma. A few years later the tumor recurs, is again excised, and the same pathologist, in violation of his previous diagnosis and the case history, pronounces it papilloma. Hence, I cannot concede any peculiar diagnostic value to the cystoscopic excision of small bits of tissue, except in cases apparently carcinomatous, upon whom one hesitates to perform a grave and mutilating operation without full pathologic justification.

Furthermore, Lower, I, and others have reported apparent cures of carcinoma by the desiccation treatment. Such being the case, it is futile to say that carcinoma should be

¹ *Ann. M. Ass.* 1910 May 28

² *Ann. J. Surg.* 1910, July

treated by the knife, papilloma by electricity, for some carcinomata can be cured by electricity, while some papillomata (as we shall see) require the knife

But perhaps the best pathological basis for distinction is that suggested last year by Chute in the chairman's address before the Genito Urinary Section of the American Medical Association. He describes the cure of a single case of vesical carcinoma after excision with only part of the muscular coat, and contrasts this with the failures that have followed wide excision in other cases. Hence, he concludes, the carcinoma that is papillary in appearance and has not deeply infiltrated the muscular coat, may sometimes be cured by the limited operation

Such is the type of carcinoma that may be cured by desiccation. But Dr Chute is the first to recognize the difficulty in distinguishing such a tumor from its more destructive brethren. Indeed, his chairman's address was a plea for more extensive operation. To this we all agree

If a malignant bladder tumor is to be operated upon at all, it must be operated upon promptly, excised widely and the involvement of pelvic lymphatics taken into account

What then constitutes clinical malignancy? What tumors should and what should not be submitted to cystoscopic desiccation?

Some years ago I endeavored to lay down rules for this clinical distinction and further experience has not materially changed my opinion. The four contra indications to cystoscopic desiccation are

- 1 Hardness of the tumor
- 2 Intractable cystitis
- 3 Sloughing or ulcerated tumor
- 4 Multiplicity and size of tumors

Some of these contra indications are not absolute, and all may be elucidated by a few words of description

Hardness of tumor The hardness of a vesical tumor may be appreciated in several ways. Rectal or vaginal touch may reveal an induration in the region of the trigone, bimanual palpation may disclose the presence of a large infiltrating tumor, or cystoscopy may reveal an ulcerated indurated carcinoma

All such conditions, we repeat, contra-indicate cystoscopic treatment.

Intractable cystitis In the four years since Beer introduced the desiccation treatment, I have never seen a case of intractable cystitis that was suitable for intravesical treatment. The patients suffering from relatively benign papilloma may, it is true, suffer from time to time the most intense cystitis. But this can be relieved by the ordinary bladder irrigations to the point of ameliorating the patient's suffering, and permitting desiccation.

But the real intractable cystitis is not appreciably relieved by any local application, is only intensified by the introduction of the cystoscope, permits only the most inadequate and unsatisfactory observation, and of itself almost prohibits treatment. Such a case when operated upon will be found to have either a sloughing carcinoma, or some condition other than tumor

Sloughing or ulcerated tumor A tumor that shows upon its surface any extensive sloughing had better be subjected to the knife. But the mere presence of small sloughs does not forbid all hope of success by cystoscopic treatment. Here, then, the contra-indication is not absolute. Let the cystoscopist, however, proceed with caution, and if a few treatments do not manifestly control the growth, let him waste no further time, but quickly have recourse to the open operation

MULTIPLICITY AND SIZE OF TUMORS

The contra indication here is even less definite than that of sloughing. Multiplicity of tumors is a perfectly obvious suggestion of malignancy. Such malignancy may be of two types. The multiple papillomata either spring from an underlying carcinoma (often an infiltration from the cervix uteri) or are propagated by surface contact. In the latter case the malignancy is a superficial one. Indeed, a very large proportion of bladder papillomata are multiple when first seen. Yet a majority of these are certainly amenable to treatment by desiccation

Size and multiplicity of tumors, therefore, present a problem in practical surgery rather than a question of malignancy. Every

urologist must decide, in the light of his own experience, whether it is more profitable to cut or to burn a given patient. It so happens that only one of my cases has defied treatment on account of the size or multiplicity of growth. Yet no doubt some of these might have been more quickly cured by the knife. It is noteworthy that though I have verified a cure by cystoscopy ten times, a year or more after the last treatment, none of the ten had more than two tumors when treatment was begun. Three others with multiple tumors (5, 5, and 7) were clean when last seen, but doubtless they will relapse again.

In a certain sense the patient's age bears on the question of malignancy. Thus among my cases there were eighteen with single tumors, of whom all but four showed symptoms before the age of fifty. On the other hand, of the nine with multiple tumors, all began after the fiftieth year.

FAILURE OF TREATMENT

But in order to do justice to his patients the urologist must be quick to recognize, not only the contra-indications to an attempt at fulguration, but also the evidence of failure in this treatment. He is dealing with a growth which is at least potentially malignant. Perhaps the very days during which he is making up his mind as to the advisability of desiccation are those during which the tumor is actually spreading to the pelvic lymph-nodes, thus making a curable case incurable. The fear of carcinoma must be ever in his soul, and a tumor however small and apparently superficial, that resists desiccation must be promptly excised.

PSEUDO CARCINOMA

It is doubtless unnecessary at this date to insist upon the chronic infiltration of the mucosa about the base of the tumor following desiccation. It simulates an infiltrating carcinoma. It may persist for at least three months, as in Cabot's case, and our only safeguard against it is the knowledge that it was not there when we began treatment, and that it may persist for several months after the last burn. The only serious complication of such an ulcer is staphylococcus in-

fection causing phosphatic incrustations. Such a complication I have seen but once (Case 2).

TECHNIQUE

Apparatus. I am not qualified to discuss the relative merits of various "high-frequency" machines. I have always employed Wappler's apparatus.

Great care must be taken not to derive the source of the cauterizing electricity from one circuit, the illumination from another. The monopolar spark produces a current through the cystoscope (statements to the contrary notwithstanding), and in one instance, at least the commingling of a direct and an indirect circuit thus produced knocked the operator senseless. (The patient I did not hear from.) Some operators therefore, always employ a dry-cell equipment for the cystoscope.

Bier maintains that copper wire is preferable to steel. I have no convictions on this subject.

Sparking. I vary the intensity of the current largely with reference to the patient's sensitiveness. When working near the bladder-wall, the smallest possible spark gap must be employed. When well away from the bladder, the insensitiveness of the tumor permits the use of a quarter-inch spark gap. When using this, it is wiser to shut off the cystoscopic light while the tumor is being burned. Otherwise the lamp may burn out.

The accepted duration of each cauterization is 30 seconds. As many cauterizations are attempted at each sitting as the patience of operator and victim permit.

Grave hæmorrhage occasionally follows the operation. Since this seems much more likely to result from a cauterization of the tumor pedicle than of its circumference, prudence dictates the slower circumferential attack. But this rule has been often violated with impunity.

Frequency of treatment. Since the burned bits of tumor do not fall off for full two weeks, this is the usual interval allowed between treatments. But a tolerant and impatient patient with a tumor so extensive that it cannot all be treated on any one occasion, may encourage more frequent treatments.

CURED CASES

Case Number	Age When Burned	Number of Tumors	Previous Duration of Symptoms	Number of Burns Each	Time Between First and Last Burn	Cystoscopic Verification of Cure of Each Tumor	
42 737	44	1		4	6 weeks	5 5 years	D Arsonval. A post-operative relapse
13 045	58	1	5 years	2	1 week	3 years	
31 843	41	1	5 years	12	5 months	1 year	First four burns elsewhere
8 736	37	1	11 years	12	7 months	11 months	Died 10 months later of chronic nephritis
55 636	40	1	8 months	10	6 months	18 months	
4 641	46	1	15 years	4	4 months	2 years	Clinically well after 4 years
43 040	60	1	3 weeks	5 5	6 weeks	3 years	Clinically well after 4 years
43 740	25	1	1 week	2	1 week	1 year	
33 847	65	1	6 years	3	3 weeks	1 year	
145	55	1	4 years	6	3 months	1 year	Clinically well after 2 years

CONTROLLED

6 647	54	1	2 weeks	2	1 week		Clinically well after 18 months.
43 340	17	1	7 years	6	3 months	1 month	
47 735	20	1	1 year	3	1 week	No	Well 14 months later
46 633	40	1		2	1 week	No	Symptomless
48 643	20	1		1		No	Symptomless.
349	70	2	10 days	1 9	2 weeks	7 weeks	
16 648	47	1	2 months	6	7 months	4 months	
17 840	36	1	1 year	3	6 weeks	No	
37 824	45	1	3 months	1		No	D Arsonval.

RELAPSING

15 841	53	3	1 month	2 1	33 months	2 25 years 0	(Case V)
45 437	61	5	2 months	4 1 1 2 3	30 months	2 years (4), 0	Post-operative relapse D Arsonval Pathologically carcinoma. Readily controlled. Died cardiac
35 840	78	5	8 years	23 4 3 1 1	4 years	2 years (3) 3 years 6 months	Controlled
11 955	64	7	4 years	4 1 11 7 4 11	18 months	1 year (4) 6 months (2) 0	Controlled
21 047	60	5	5 years		1 year		Still under treatment

REQUIRED OPERATION

30 445	27	1	10 days	2	2 weeks		Because of severe cystitis.
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Antisepsis The burned tumor is practically a foreign body and offers an unusually good breeding ground for bacteria. Consequently antisepsis should be especially careful. I am at present employing 1:2000

solution quinine bisulphate as the medium for cystoscopy (as suggested by McDonald).

Care between treatments The patient must at all times be under a physician's observation. No amount of care can absolutely

eliminate the possibility of cystitis, pyelonephritis, or grave hemorrhage, any of which call for prompt treatment

Verification of cure. The cure must be verified by cystoscopy after three months and again after a year, and three years

COMPLICATIONS

The chief complications following the desiccation treatment of bladder tumors are:

1. *Electric shock* (already mentioned).
2. *Loss of time* in diagnosing a tumor that requires suprapubic section (already mentioned).
3. *Neglect* The patient may "elope" either because he thinks himself well when his bleeding stops, or because he fears another cystoscopy. Such patients should be cut, when recaptured.
4. *Infection.* Cystitis following cystoscopy must be treated by frequent irrigation with silver nitrate.

I venture to subjoin the only two cases of grave infection I have seen.

CASE 1. Mrs F age 53 came to me on February 8, 1913, with a history of hæmaturia a year before, frequent urination since then, and a recent cystoscopic diagnosis of papilloma. This I confirmed, the cystoscope showing a large papilloma to the right of the trigone. The urine was purulent.

The patient was burned 7 times in the following 3 months. As the tumor was reduced a small implantation growth was found on the fundus.

She then remained away for six months and returned, having gained ten pounds, but with her tumor about as large as when first seen. I burned it once and she returned again in February, 1914. I then burned three times. Incrustations formed upon the bases of the tumors. Ewing reported an excised specimen simple papilloma.

She then departed for six months more and on her return (September, 1914) I burned the tumors several times and administered many irrigations with Bulgarian bacilli in various forms, buttermilk, and lactic acid bacilli. In spite of these treatments the ulceration gradually spread over the bladder and on February 6, 1915 I performed suprapubic cystostomy, found four incrustated ulcers running from the right side of the urethral orifice up into the fundus and a few small scattered incrustations just above the urethra. No tumor was visible. The ulcers were well cutted and the bases burned well with the actual cautery. The bladder was sutured without drainage. A small fistula opened on the seventh day and closed two weeks later. During her convalescence she was treated by in-

stillations of carbolic acid and irrigations with silver nitrate. In spite of this, six weeks later her incrustations were as bad as ever. Then a dozen injections of bacillus acidophilus relieved her symptoms, resulted in discharge of the phosphatic incrustations, and banished the staphylococci from her urine.

CASE 2. Mrs J, age 50, consulted me on January 6, 1915, for a violent cystitis of 3 months' duration. I found much pus, many colon bacilli, 0.2 per cent of albumin by weight. The X ray was negative, the cystoscopy showed extensive papilloma.

As a result of this cystoscopy (though no attempt had been made to catheterize the ureters) she developed an acute infection of the right kidney which subsided at the end of ten days.

I set a date for suprapubic section, and on arriving at the hospital at 9 a.m. found her temperature had risen during the night to 102°. Deeming that drainage would do her no harm I promptly operated, excising one small papilloma near the line of incision (this was reported benign) and removed a great number of others by the thermocautery. The peritoneum was intentionally opened, and a line of very slightly enlarged glands were found following the course of the right internal iliac artery, these were not excised. A small drainage tube was left in the vault of the bladder.

After operation the temperature dropped promptly to normal. The fistula healed in two weeks. Her bladder irritation thereafter was controlled by instillations of 2 per cent carbolic acid.

Two months after operation the cystoscope revealed a single tuft of papilloma behind the right ureter. This was readily burned.

I know of two deaths from infection after desiccation treatment employed by other surgeons. In each case the death was attributed to "pericystitis," but unfortunately the details are not available.

5. *Hæmorrhage.* The sloughs of burned tissue may begin to come away within two or three days of the cauterization, but as a rule they separate in the second or third week. At this time quite a sharp hæmorrhage is likely to occur. The patient should be informed of this that he may not be unduly alarmed, and, if he is out of reach of the operator his physician should be warned to be ready to aspirate bladder clots.

Three of my patients have had retention from clots during the second week after a burn, two were relieved through a soft rubber catheter, the third required the litholapaxy tube followed by a retained catheter for 24 hours.

Among the two hundred cases collected by Beer there were three instances of severe bleeding.

That the bleeding may come on more immediately is exemplified by the following two cases.

CASE 3 (Communicated by Dr E. L. Young) Male, age 40, showed a large papilloma of the bladder which was destroyed in twelve burnings. Three months later a small recurrence was very thoroughly burned, the wire being applied to the base of the tumor. Two days later hematuria began and continued for six days, at the end of which time the patient, almost exsanguinated, had to take to his bed. An indwelling catheter was applied and at the end of 48 hours the bleeding was controlled.

CASE 4 (Communicated by Dr James A. Gardner) Male with large single papilloma. Burned fourteen times (d'Arsonval) from July 2 to December 3, 1913. At the latter date he had gained 10 pounds and the tumor was reduced to a relatively small size. After this cauterization he went home, and immediately began to bleed. He was taken to a hospital where his local physician operated, found "a ruptured bladder" and the patient died December 7.

Obviously hemorrhage is one of those important complications that cannot be fully guarded against but may be controlled by expert treatment.

RELAPSES

Among Beer's collected cases ten recurrences are noted, but no statement is made as to the time of recurrence. In reference to this the cases may be clinically divided into two types: one in which the tumors are few in number and show no tendency to multiply, the other in which multiple tumors at the time of the first examination suggest a tendency to surface inoculation, which suggestion is often borne out by the appearance from time to time of recurrences in various parts of the bladder. Such recurrences cannot be guarded against, either by cystoscopic or operative treatment, though it is in these very cases that the cystoscopic treatment offering as it does the ideal opportunity for repeated attack upon the neoplasms while they are still young, is immeasurably superior to open operation.

It is further to be noted that careful examination of the bladder in such cases usually

discloses a number of small tufts that may be burned off very readily, thus preventing the development of further tumors.

But the relapses with which we are particularly concerned are tumors occurring at the point from which a tumor has been burned away. Such relapses not unfrequently appear during the first three months after the apparent destruction of the tumor, and therefore must be guarded against by a confirmatory cystoscopy at this interval.

But if this confirmatory cystoscopy shows the site of the tumor to be normal, the prospects of further relapses at this point are extremely small. I have seen none, Beer has seen none, and in the large number of cases reported to Gardner as the result of his questionnaire, only one such relapse *in situ* is recorded (this, by Gardner, himself), a recurrence after an interval of three years.

Thus among my 27 cases I have seen only one recurrence *elsewhere in the bladder* after a long interval of health.

CASE 5 Male, age 52, showed one tumor near the right ureter orifice from which he had been bleeding intermittently for two months. This was destroyed by two burns. The cure was verified a year later but 20 months after that (almost 3 years after the destruction of the first tumor) a new small papilloma was seen and burned off at a different point on the bladder wall. This tumor had not yet given any symptoms. The patient has not been seen since.

But even today we are in no position to estimate with any degree of accuracy the probability of recurrence of bladder tumors.

Only one gentleman with whom I have communicated has expressed the conviction that such relapses are very common. He reports twenty-five cases, of which three are supposed cures though but one has been verified after one year by cystoscopy. The remaining twenty-two have all recurred "within six months to three years after the last treatment." He states that "the recurrences have almost invariably been on sites remote from the primary outgrowth," and adds his conviction that after any operation "short of total cystectomy a recurrence will be observed in 90 per cent of all cases within a period of six years."

Careful confirmatory cystoscopy three months after apparent cure would, I believe, modify this gentleman's views by disclosing the wee tufts of villi whose later growth he characterizes as relapse.

PERSISTENCE OF CURE

Out of 27 personal cases, one eloped; 5 have relapsed for varying periods of time (1 to 3 years), of whom only one has not yet been controlled, two (Cases 1 and 2) have been operated upon, nine were apparently cured, but the cure has not been verified by cystoscopy a year later. Ten cases have, however, been so verified: six after one year or more, three after two years, one after five and a half years.

Adding to these cases those that have been kindly communicated by nine other surgeons, I am able to report 126 cases. Of these 25 have been cystoscopically proved free from disease at the end of one year, 26 more at the end of two years, and 14 at the end of three years or more.

CONCLUSIONS

1. Tumors of the bladder must be classified as benign or malignant in accordance with their clinical characteristics, especially their reaction to the desiccation treatment.

2. The clinical characteristics of malignancy are hardness of the tumor, intractable cystitis, and sloughing or ulceration of the tumor.

3. Multiplicity and size of tumor militate against the success of any form of treatment. The surgeon will have to decide from his own experience which cases are to be selected for desiccation, and which submitted to operation and desiccation afterward.

4. When a bladder contains more than two or three tumors we may prophesy a continual tendency to relapse, and we must insist upon the closest vigilance after apparent cure.

5. For two weeks after each treatment the patient should be within call of a physician qualified to care for either infection or hæmorrhage.

6. Cures should be verified, as follows: Cystoscopy must show the bladder entirely healed. Three months later cystoscopy must be repeated. One year after this it must be repeated again. Further cystoscopic verification must be made at periods of about three years. For how long the tendency to relapse continues, we do not know; but after the first year it is probably slight.

7. Death has resulted once from hæmorrhage and twice from "pericystitis."

RADIUM VERSUS SURGERY IN THE TREATMENT OF VLSICAL NEOPLASMS

By J. BLNTLEY SQUIER, M.D., F.A.C.S., NEW YORK

ALTHOUGH the yearly production of radium element for the entire world is at the present time about one third of an ounce, the vast amount of investigation concerning its therapeutic value which is being carried on may be appreciated from the fact that since 1901 over twenty-five hundred monographs and papers have appeared upon its various actions and possible uses.

Surprising it is, therefore, that even though ten years have elapsed since the application of radium to the treatment of malignant tumors, certain fundamental information concerning its therapeutic capacity is still lacking. One explanation of this seems obvious, namely, that our knowledge of the real cure of cancer will depend upon our knowledge of the real cause of cancer, and the finality of one will absolutely depend upon the accuracy of the other.

Let us suppose, for the sake of argument that radium acts as a pure cautery, but with the added possibility of destroying cancer-cells without giving injury to normal tissue, and also let us accept for the moment the discovery of filterable viruses producing different types of sarcoma as a proof of the parasitic hypothesis of the cause of tumor formation. Or, let us take a less radical view and consider that the agent which produces malignancy in a normal cell is a biochemical one, acting from without the cell. How then can we hope that any agent that causes merely cell destruction is the long looked for cure for cancer?

If it is proved true, as many investigators now believe, that the so-called "precancerous stage" may be of a constitutional nature and not simply locally predisposing, we would have to give up any form of surgery as being the ideal therapeutic measure in dealing with malignancies, and we would have to consider excision of the cancer as futile of result as excision of the primary lesion has proved to be in the cure of leuc. However, until the

laboratory gives us more definite data from which to deduce conclusions, we will have to consider that local removal or destruction of cancer is the only justifiable method of treatment, and we will push ahead in this belief.

In a general way we might sum up our present knowledge concerning the therapeutic value of radium in the treatment of cancer about as follows:

It is not at present known what quantity of radium must be applied to kill a cell of a cancer within a given distance. It is perfectly certain that in the benign epitheliomata of the face, including many types of basal cell epitheliomata, radium is capable of inducing a cure, since there are already a sufficient number of observations on human beings to enable us to make so positive a statement. We do know that radium will not cure a carcinoma or sarcoma at a distance of, say, three or four inches from the tube. This has been shown by the work of Kronig and Gauss and Bumm in Germany, who have published a series of cases of carcinoma of the uterus which have shown recurrence at a considerable distance from the site of the radium application, even though the primary carcinoma in the uterus had been completely destroyed. As far as one can now judge it is useless to expect any effect from the quantities of radium now available at a greater depth than about two inches from the tube. Within this distance it is often possible to influence tumor growth, but the quantity of radium required is so large that but few have the necessary amount. By large quantities is meant four or five hundred milligrams, which at the present market price is worth sixty to seventy thousand dollars. The application of these large quantities, however the radium may be protected or screened, frequently results in serious burns of surrounding tissue which do not heal for a long time. Therefore extreme caution in application is necessary when applying radium to vesical tumors.

It is well known that many of the bladder papillomata are benign or at least not extremely malignant. If such growths can be approached either from the urethra or through a suprapubic incision and the radium placed in contact with the base in quantities of 200 mg and for an exposure of twenty-four to forty eight hours, there is no question but that a good deal of effect may be secured within a radius of two to three inches from the site of application. The danger of deep ulceration with the production of rectovesical fistulae or fibrosis must, however, always be kept in mind and guarded against.

In the malignant tumors of the prostate, involvement of the rectum or at least close approach to the rectal wall is not infrequently noted. In such case the greatest care must be taken not to radiate too long, and the tube should be buried in the body of the tumor so as to get the full effect of all the rays in all directions. Merely laying the tube in the bladder over the surface of the growth cannot be expected to do much good. The final results of the application of radium to the bladder and prostate tumors cannot at present be estimated from the clinical side, for the reason that the number of cases thus reported is small, and of these many have not been studied microscopically and therefore must be excluded, and most of the reports have been made before a sufficient time has elapsed to make it possible to judge whether the cure is permanent. Certainly, with our knowledge of the slowness of the growth of certain prostatic tumors, some of which do not recur extensively in less than one or two years, it is the height of folly to report a cure at the end of two months. We must rather wait patiently for at least three years before even considering that the results may be permanent.

It is wiser then not to consider radium as the primary therapeutic choice in the treatment of vesical tumors where operation is possible. If the operation has been necessarily incomplete, it may be wise to radiumize the field thoroughly with large quantities of radium in order to destroy cancer-cells which may have been distributed throughout the field of operation and those which have re-

mained beyond it. When a tumor has recurred after operation the use of large quantities of radium may check the course of the growth for a certain length of time, but the use of small quantities is to be deprecated, for stimulation with increased rapidity of the growth of the tumor may result from the application of an insufficient quantity.

My experience with the use of radium has been limited to a number of cases of extensive vesical carcinoma, and personal observation of the work of Dr Francis Carter Wood, Director of the Crocker Cancer Laboratories of Columbia University, in experimenting with radium in mice tumors.

The vesical carcinomata cases were those who had previously been subjected to operation for the removal of the growth. In each instance, the incompleteness of the surgical removal was recognized at the time of operation and the patient at once given the benefit of the application of radium to the unremoved tumor. The technique was the same in each case. Eighty to 100 mg of radium element screened with 1 mm lead 2 mm paper, and a thin sheet of rubber were applied to the tumor through a large suprapubic tube. This was left *in situ* for varying periods of time, the shortest period being six hours, the longest period being thirty-six hours. The number of applications was usually three. The immediate results were similar in all cases, a checking of hæmorrhage, an inhibition of bacteriuria with markedly diminished pus in the urine, and, strange as it may seem, a feeling of well-being expressed by the individual. In all the patients, the suprapubic wounds healed quickly. Each patient died of an extension of the growth within six months of the operation. In no case was there a return of vesical hæmaturia, the extension being into the pelvis or peritoneal cavity. The number of cases treated was four.

Appreciating that these cases are not at all conclusive and that they add but little to the scientific data concerning the therapeutic value of radium, it may be of interest to include in these remarks some of the data derived from animal experimentation carried out by Dr Wood.

The experiments comprise quantitative studies of the lethal effect of radium on tumor-cells. They are undertaken because of the paucity of information attainable from the writings of various experimenters, working both with human and with animal tumors, on the quantities of radium used, the screens employed, and the time of exposure. These factors being the only ones which would furnish a scientific basis for computing the efficiency of radio active substances, experiments were carried out with the idea of solving some of the above mentioned problems.

Rat and mouse tumors of various types were used. These were treated *in vitro* and *in vivo*. Following an exposure of the B and P-rays in different amounts and for varying periods of time, portions of the treated tumors and untreated controls were inoculated into animals of the same strain. The A-rays were not employed, as they are soft rays, causing superficial burns.

The B rays, composed of soft, medium and hard rays, were found to be screened as follows: The absorption limit of the soft rays was 0.4 mm brass. The medium and hard rays would penetrate such a screen for about 0.8 mm. To absorb the medium and hard B-rays 1.2 mm of brass was required.

The P rays are the most penetrating. They passed through 1.2 mm brass. Upon striking the metal used to remove the B rays, the P rays produce a soft secondary B-ray of very slight penetration. These are blocked by a screen of filter paper 5 mm in thickness.

Filtering out the B rays greatly increased the time required to produce a lethal effect. After a long series of experiments it was found that exposures of seven hours to 100 mg of radium were necessary to kill the tumor cells with the B-rays filtered out.

From a series of inoculation experiments on a previously radiated tumor it was shown that from as large a quantity of radium as 83 mg of the element with an exposure of two hours the tissue was not affected at a distance of 1 cm, the inoculated radiated tumor growing as rapidly as the unirradiated controls.

Wood calls attention to the action being governed by the law of inverse squares. "If the distance of the tube from the proximal portion of the tumor is 2 mm, and from the distal portion 12 mm, then the effect is not as 1 to 6 but as 4 to 144 or as 1 to 36." His experiments seemed to prove that in radiated tumors the slowness of growth after inoculation was probably due to injury of the mechanism of mitotic division of the cells. Wood's conclusions are:

1 "Three factors only are dominant in the action of radium on tumors; i. e., the time of exposure, the amount of radium element, and the distance between the tube and the tissue to be acted upon.

2 "The removal of suitable filters or the greater part of the B-rays diminishes proportionately the lethal effect of the radium, but that this P-ray effect follows the same law as that governing the B rays.

3 "Sublethal exposures slow the growth of tumor cells for some time, while a still shorter treatment seems to stimulate the cellular growth activities."

Therefore in the light of our present knowledge we believe that cures in bladder tumors by the use of radium may be hoped for only in benign papillomata, that it may be possible in certain instances to render the symptoms of vesical malignancy less distressing by intra urethral suprapubic, rectal, or cross fire intra urethral and rectal radiations, that by the time vesical carcinoma has been made clinically manifest the growth has already extended too far to be readily influenced by the amounts of radium at present at our command, that the question of the best management of a case of vesical carcinoma is no different than the management of carcinoma anywhere else in the body — and such is if the growth is anatomically accessible wide surgical extirpation followed by every means known of science to treat any unremoved growth or recurrence.

We may find, however, as further experience develops more ingenious means to use radium intravesically that radiating the tumor before operation may lessen the danger of tumor transplants occurring at the time of operation.

THE PATHOLOGICAL DIAGNOSIS OF TUMORS OF THE BLADDER WITH PARTICULAR REFERENCE TO PAPILLOMA AND CARCINOMA

A STUDY OF ONE HUNDRED THIRTEEN NEOPLASMS¹

By LEO BUERGER, M.D., F.A.C.S., NEW YORK

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ALTHOUGH much has been written about the difficulty of differentiating with certainty between carcinoma and papilloma of the bladder, very few, if any, systematic and comprehensive pathological investigations have been made from both the histological and clinical viewpoints with correlation of the findings. It is generally believed that such differentiation is often impossible and that neither the cystoscope nor the pathologist can give definite and reliable opinions. From a study of one hundred thirteen tumors of the bladder that have come under our observation at the Pathological Laboratory of the Mount Sinai Hospital during the past ten years, and from a study of many other vesical tumors (more than twenty five in number), where the material, however, was not sufficient to be included in the series, we have come to the conclusion that the pathological diagnosis of carcinoma is possible in most cases. Through the kindness of Dr. F. S. Mandlebaum, Director of the Pathological Laboratory of the Mount Sinai Hospital, a large part of this material was put at our disposal, the rest was collected from cases in our own practice.

The opinion that pathological diagnosis is not reliable has been widely accepted. On critical study it becomes evident that credence in this view has become established by the support of some correct assumptions, but depends also upon many fallacious conceptions. We could summarize the various pathological and clinical notions that have led to the erroneous belief that diagnosis on a pathologic basis is not reliable, as follows: First, papilloma recurs in the bladder interior in a larger percentage of the cases, second, papillomata may diffusely involve the whole bladder, producing a condition of papillomatosis with a malignant clinical course;

third, papilloma is often indistinguishable from carcinoma with the cystoscope; fourth, papillomata may be present and grow over a carcinoma, fifth, it has been contended that it is impossible to obtain adequate material for histological studies by any cystoscopic or non-operative means, sixth, metastases may occur in the wound after suprapubic operation, even though the primary tumor was papilloma, seventh, the frequent association of single or multiple papillomata with a carcinoma in the bladder, eighth, papilloma has been regarded as indistinguishable from carcinoma with the microscope, and that if morphological criteria exist, they are not dependable, ninth, if carcinomatous changes occur in a papilloma, they take place in the so called "depth" or in the "base" of the tumor, where they are inaccessible to our methods of examination.

If we analyze carefully all of these notions that could shake a belief that pathological differential diagnosis between carcinoma and papilloma is possible, we find that only the first three conceptions are true. All the others are fallacious.

When we first took up the question as to whether the possession or the acquisition of biological traits of malignancy is accompanied by demonstrable structural variations from the normal benign type in tumors of the bladder, we were inclined to be skeptical. As time went on, however, our concepts became completely changed, and the opposite conclusion has been reached, so that today we are willing to go on record as holding the belief that in most cases the acquisition of malignancy from the clinical standpoint goes hand in hand with the appearance of definite histological changes in the type of growth, and that these should be recognized by the expert pathologist.

¹From the Department of Surgical Pathology Mt. Sinai Hospital.

The recognition of carcinoma of the bladder on a pathological basis must depend upon the following: First, that morphological characteristics varying from the benign type *do occur* when a tumor either possesses or has acquired the clinical traits of malignancy, second, that material can be obtained in which certain morphological criteria indicative of malignancy can be demonstrated, and third, that the examiner possesses the power to recognize these criteria when they do occur.

In the course of this paper it will be shown definitely that morphological changes do occur in most instances, in fact, in all the cases of carcinoma of the papillary variety with but one exception was this the case.

As regards the obtainment of material, methods for carrying this out have been suggested by the author in previous papers;¹ the use of the operating cystoscope having been recommended, together with the punch forceps, or the snare, in cases of papilloma.

In the elaboration of the theme the subject matter will be divided in the following way:

I The morphological criteria upon which a diagnosis of papillary carcinoma can be made.

II The circumstance that these criteria occur in portions of the tumor that are accessible to our diagnostic methods since—

A They are present *not* in the inaccessible "depth" of a tumor, but in the approachable parts of papillomata that have undergone malignant change and since—

B They are present throughout the neoplasm in the case of primary carcinoma.

III The application of these criteria in the classification of my series of one hundred thirteen tumors, including a demonstration of their value in recognizing the true nature of those tumors that otherwise would be and have been incorrectly diagnosed.

TYPICAL PAPILLOMA

For a thorough understanding of the histological criteria upon which a diagnosis of

carcinoma may be based, it is necessary to have a definite knowledge regarding the normal limit of variations from what may be called the typical papilloma growth. The pathological anatomy of the true papilloma is so well known that I need hardly go into detail regarding it here. For an appreciation of the points to be brought out in this paper, the following structural characteristics alone need be pointed out:

Papillomata appear either as pedunculated growths or as sessile tumors. They vary considerably as to size. The pedunculated form, which is the most common, is distinguished by its pedicle. Its presence, however, is often overlooked, since by virtue of extensive arborescence it may be completely shrouded from the view of the cystoscopist. For this reason, many tumors are regarded as sessile when they really belong to the pedunculated type. If we look at a section of such a growth (Fig. 1),² we will note that the pedicle rises perpendicularly from the surface and that it may grow into the bladder lumen for a considerable distance before villi are given off. The submucous tissues hypertrophy considerably and the pedicle contains many new formed vessels, some of large caliber but thin walled, others smaller with thicker walls. A knowledge of the general architecture and microscopic structure of the pedicle is important for a correct conception of what "infiltration" of the so-called base of the growth with carcinoma may mean. In general, a thorough study of the pathology of these growths will reveal the fact that ablation of the tumor by means of a snare or other instruments would leave the bladder wall perfectly intact except for a moderate sized hiatus in the mucous membrane.

Similar conclusions can be arrived at when, after the use of the snare, the region of the base, root, or pedicle is extirpated with the cystoscopic punch forceps. A study of a number of specimens was made in this way. In some instances we found at the periphery of the pedicle a tendency of the mucous membrane to proliferate, attended with some

¹ Buenger. *Tr. Am. Urol. Ass.* April 1913.

² A clinical study of the application of improved intracystoscopic operative methods in diagnosis and therapy. *Med. Rec.* 1913, June 21. *Zur Klinik der Operationen—Cystoskopie*. *Zentralbl. urol. Chir.* 1913, I, No. 5. Concerning certain problems in urethrocystoscopic diagnosis and treatment (with description of a new instrument). *Am. J. Surg.* 1915, February.

² I am indebted to Dr. F. S. Mandelbaum, Director of the Pathological Laboratory, Mt. Sinai Hospital for the preparation of the photomicrograph reproduced here.

inflammation of the submucosa, or with the production of minute villi in the surrounding mucous membrane. But as a rule, if marked inflammation is absent, there is little of that intense proliferation of the epithelial elements, and little of that edema which is so characteristic of the infiltrating carcinoma.

An investigation of the base of the papillomata during life, that is, by means of the operating cystoscope, shows that we can remove by means of the punch forceps practically everything that is left of a papilloma after the use of a snare.

Sessile papilloma. It is essential to have an exact idea of the histology of these growths in order to explain the possibility of certain types of infiltrating carcinoma that may develop in them and to appreciate the difficulty of a thorough removal of this type of growth.

A reference to Fig. 2 will show the general conformation of this type of growth and the relation of its epithelium to the surrounding mucous membrane.

The histology of papillomata. Regarding the villi, we may group these into two types: the massive villi with many layers of cells, and the slender villi that vary only as to length. The massive type has a tendency to fuse, so that enormous nests of cells are produced. To the inexperienced eye, these may give the impression of solid carcinoma, particularly when the section is made perpendicularly to the long axis of the papille.

Certain of the atypical appearances noted in papillomata are not to be regarded as indicative of malignancy. Some of these are degenerative others metaplastic. There may be, first, the formation of glands or cysts, the conversion of the epithelium into cylindrical and cuboidal epithelium with the acquisition of the property of secretion, second, intense inflammatory invasion with round cells, infiltration of the epithelium with fine fusiform cells, probably angioblasts, third, conversion of some of the cells into squamous cells, such as are within the normal type of cell.

There are certain other changes that must be differentiated from those which we regard as evidences of malignancy. These are a slight variation in the size of the nucleus —

nuclei larger than normal — and a tendency for the basal cells to vary from the normal. In places, cells similar to the fusiform malignant variety are encountered. On the whole, however, none of these changes are sufficient to the experienced eye for a diagnosis of variation from the normal, nor are they to be regarded as suggestive of malignancy.

In the sessile papillomata there is marked proliferation of epithelial cells in a fashion similar to that observed in the case of certain flat papillomata or condylomata of the integument. The margin of these growths was studied in a number of specimens. In small tumors of this variety we often find that the epithelial proliferation is nothing more than an exaggeration of the von Brun-Limbeck's nests, and we must regard some of the neoplasms as originating from these formations.

If we study the epithelium in the neighborhood of such growths, we will often see papilloma formation in its earliest stages. Thus we may see single tufts or solitary excrescences which present rather long, finger-like growths of connective tissue surrounded by epithelium. The submucous tissues under these flat tumors often show evidences of infiltration with round cells, but not any more extensively than the surrounding epithelium.

Recurrences in papilloma. It is a well-known fact that recurrences take place after the removal of papillomata, whether the high-frequency method be employed or whether a surgical operation be done. It is also known that papillomata may occur elsewhere in the bladder after the removal of the primary growth. Our own observations have shown that carcinoma and papilloma may exist in the bladder at the same time, and that after a primary papilloma there may be a recurrence of the papilloma in one part of the bladder and a growth of carcinoma in another. We have further been able to demonstrate that papillomata may develop in other parts of the bladder even after carcinoma has made its appearance. This is important in diagnosis, because the mere fact that a diagnosis of papilloma is made on a section removed from the bladder does not mean that carcinoma is absent. We must remember that a carcinoma and a papilloma may both

be present at the same time. That this is true, not only autopsy specimens, but also clinical findings and microscopic studies, have shown us. It is necessary, then, to obtain material from the carcinomatous growth itself for pathological diagnosis.

Our studies have brought us to certain conclusions as to the possible course of recurrences of papilloma. There are several possibilities: Papilloma may recur as papilloma, papilloma may be followed by a condition of papillomatosis; papilloma may be followed by primary carcinoma, by a papilloma which has become converted into a carcinoma, or by multiple papillomata, one or more of which may become carcinomatous.

We believe that the recurrence of papilloma, as such, cannot be regarded as indicating that the primary growth was malignant, nor that the new tumor is necessarily of that nature. All our clinical, as well as pathological, data point to the benign nature of this type of growth. Although it has been found in the case of carcinomatous change of papillomata that certain cell variations are characteristic, a very careful investigation of those cases of papilloma which recur as papilloma fails to reveal any such cellular anomalies. At any time, however, as will be shown further on, either a primary papilloma or its recurrence may acquire malignant properties, the objective manifestations of which can be visualized with the microscope. Certain it is that in many of our cases recurrences were shown both clinically and pathologically to have acquired malignant properties either as primary carcinoma or papillomata that had undergone carcinomatous change.

I THE POSSIBILITY OF PATHOLOGICAL DIAGNOSIS

What are the morphological criteria upon which a diagnosis of papillary carcinoma can be made? In discussing this theme we will point out what are the histological criteria upon which a pathological diagnosis of carcinoma can be made, will show that these were present in all of our cases of malignancy, will demonstrate by a study of those papillomata that have undergone early change

where these alterations occur, namely, in accessible portions of the tumor; and, finally, will review the diagnosis of all of the various types, with a view to demonstrating how a diagnosis should be made in each instance.

It was only after a very thorough pathological investigation of papillomata and carcinomata that the conviction was forced upon us that certain peculiar abnormalities in the conformation of the cells regularly mean either the presence of primary carcinoma or carcinomatous change in a papilloma. These abnormalities are cells manifesting irregularities in size and shape; nuclei rich in chromatin, deeply staining and of bizarre shape, cells with atypical mitoses; giant cells and multinucleated cells. All these, when occurring in papilloma of the bladder, indicate the presence or beginning of carcinomatous change. It will be granted that certain variations in the type cell belong to the benign growths, and that the proper estimation of such changes depends to a great extent upon personal interpretation. It is true that in such matters as these no hard and fast rules can be laid down, and we can only in a general way indicate from personal observation what types of variations from the normal can be regarded as indicating malignancy. In the case of other organs, such as the thyroid, the liver, etc., atypical cells *per se* cannot be regarded as evidences of malignancy. In the bladder however, our experience has led us to conclude that, whenever such cells are present, a very thorough search through the tumor will often disclose other distinct evidences of malignancy. Another and most reliable evidence of carcinomatous change will be found in a disturbed relationship of the cells to each other, in a loss of the typical palisade arrangement of the cells, in the presence of long fusiform or compressed types of cells in the existence of evidences of infiltration of the stroma and penetration of the basal membrane, in the presence of cells in the capillaries and finally, in the occurrence of epithelial cells in the submucosa or muscular coats of the vesical wall.

These criteria have enabled us to recognize the presence of a malignant tumor in seven-



Fig 1



Fig 2

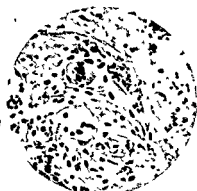


Fig 3



Fig 4



Fig 5



Fig 6

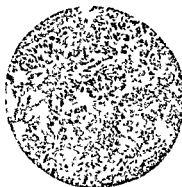


Fig 7



Fig 8



Fig 9

Fig 1 Typical papilloma

Fig 2 Sessile papilloma

Fig 3 Atypical multinucleated squamous cells in indicating carcinomatous source

Fig 4 Atypical nuclei and cells, papillary carcinoma

Fig 5 Atypical fusiform cells adhering to high frequency electrode — from same case as Fig 4

Fig 6 Same source as Figs. 4 and 5, small celled papillary carcinoma, proof of reliability of morphological criteria.

Fig 7 Above cells of bizarre shape etc. below and to the right muscle infiltrated with papillary carcinoma

Fig 8 Atypical cells (fusiform type) in small amount of material (Case 4)

Fig 9 Section through tumor and bladder wall (Case 4), on surface phosphatic encrustation, below diffuse infiltration of wall with papillary carcinoma down to peritoneum

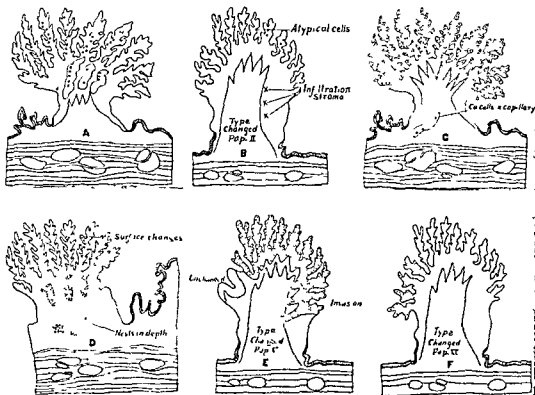


Fig. 12. a to f. Schematic drawing of types of 'changed' papillomata. Heavy dots indicate changes in cells. a, Type I atypical changes in villi both near surface and near to pedicle. b, Type II atypical cells in villi (accessible), infiltration of stroma near base of villi or between villi (accessible). c, Type III extensive surface changes, carcinoma cells in a capillary in pedicle, showing that although superficial material gives us diagnosis macro-

scopically appearances give no clue as to condition of pedicle. d, Type IV association of surface changes with changes in deep layers of villi and in submucosa. e, Type V, extensive surface change only small focus of papilloma unchanged here and there invasion of pedicle. f, Type VI, carcinomatous change beginning in the peripheral portions of the papilloma elsewhere there is occasional evidence of change.

teen cases where the material would have led to an incorrect or a doubtful diagnosis, if our present standards were rejected. If we accept these criteria, we shall also be able to diagnose malignancy from a relatively small amount of material, and the report "insufficient for diagnosis" such as is often made by the pathologist will be less frequently given.

To illustrate Fig. 3 is taken from bladder washings in a case of a clinically doubtful tumor of the bladder. A study of this slide reveals many atypical squamous cells, cells with atypical lobulated nuclei, atypical mitoses, etc., in short, cells that may be re-

garded as emanating from a carcinoma. A subsequent section from additional material proved the case to be one of squamous-celled carcinoma.

Another instance in which the value of the cellular changes and abnormalities in diagnosis is well demonstrated is Case 18 (M. B.). Here the first specimen remained undiagnosed (August 14, 1911 and August 26, 1911). On thorough examination of this specimen (Fig. 4) we find the atypical cells, the fusiform cells, deeply staining cells, in short sufficient evidence to warrant the diagnosis of carcinoma. Figure 5 taken from material obtained during treatment with the



Fig 10



Fig 11



Fig 13

Fig 10 Changed papilloma, above and to the right, atypical cells in base of villus, center and left, squamous type of carcinoma cell invading stroma and penetrating villus (Case 22)

Fig 11 From tumor easily mistaken grossly and

microscopically for papilloma, on right, almost indistinguishable from papilloma, in center, cells invade stroma (Case 9)

Fig 13 After Mandlebaum,³ carcinomatous change in epithelium of villus (Case 52)

high-frequency current¹ should also have been regarded as being carcinomatous, because of the atypical fusiform cells and the atypical nuclei. Subsequent material, as well as the autopsy specimen, shows that we were dealing with a papillary carcinoma. Figure 6 shows the papillary carcinoma with cells resembling the papilloma cells, but staining more deeply, more rich in chromatin, and diffusely invading the connective tissue and muscle.

We have observed many other such cases. In Case 14 (P B), where the fulguration material included atypical cells, but was not considered ample for diagnosis, subsequent material showed (Fig 7) not only the atypical cells, but papillary carcinoma infiltrating the muscle.

In Case 4 (T T) the material excised from a papillomatous growth (Fig 8) — revealing the atypical fusiform cells and the peculiarity of the arrangement of the cells — should have been sufficient for a recognition of the malignant nature of the tumor. Figure 9, a section of the tumor obtained later by resection, disclosed a diffusely infiltrating papillary carcinoma with phosphatic encrustations on its surface.

Still more suggestive is the combination of atypical cells in the papillomatous portion of the tumor and the infiltration of the stroma

with cells that are distinctly carcinomatous. Such large cells are often of the squamous variety (Case 22), traceable to a metaplasia of the tumor, some portion of which has become carcinomatous (Fig 10).

Concerning the other criteria that must be relied upon in diagnosis, we may mention infiltration of the connective-tissue stroma. This, it will be granted, is accepted by all pathologists as an indication of malignancy. But, in our experience, it is usually accompanied by the cellular changes above referred to. Thus, in Case 9 after very careful search, to which we were incited by the finding of atypical cells, we were successful in finding areas of infiltration (Fig 11) and islands of cells in the stroma as further evidence of the malignant nature of this growth.

In short, as has already been pointed out by Zuckerkandl² (although his statements are not absolutely convincing because of the absence of definite case and pathological reports), the presence of certain atypical changes in the cells either without or associated with evidences of infiltration in the stroma, islands of cells in the stroma, cells in the capillaries, etc., all these must be regarded as expressions of carcinomatous change or of the presence of a primary carcinoma.

A study of fifty-two carcinomata, forty-five

¹ Loc. cit. Thanks are due Dr. Mandlebaum for use of these photographs.

² Zuckerkandl, Verhandl. d. deutsch. Gesell. f. Urol. 1909.

¹ Refers to tissue adhering to the high frequency electrode.



Fig 14

Fig 14 Same low power below and to left submucosa in center note area depicted in high power Fig 13 Carcinomatous change in epithelium of surface does not reach submucosa ("depth") (After Mandelbaum)



Fig 15

Fig 15 Cross-section of changed papilloma (Case 43) with general structure of papilloma, contains atypical cells



Fig 16

Fig 16 Focus of Case 43 showing infiltration of stroma

of which were papillary, five squamous, and two metastatic demonstrated that manifestations of structural variation from the normal papilloma type could be found in all but one case. The peculiar nature of this one exception to the rule will be discussed later on, at the present moment it need merely be pointed out that one variety of malignant papilloma "an infiltrating papilloma" need have none of the cellular earmarks of malignancy at least as far as our material could disclose.

A review of material obtained between the years 1905 and 1914 inclusive shows that in a number of instances of carcinoma the diagnosis would have to be regarded as doubtful, but on the basis of the criteria set down by us in 1915 a correct diagnosis could be made in every instance.

II THE PRESENCE OF MORPHOLOGICAL CRITERIA

The morphological criteria are present in parts of the tumor that are accessible to our diagnostic methods occurring in papillomata that have undergone early malignant change, and certainly also in the primary carcinomata.

A Perhaps the most instructive variety of papillary carcinoma is that in which we have reason to believe a papilloma is undergoing malignant change. The question as to whether this occurs or not has been a

mooted one for many years. Pathologists have expressed diametrically opposite views, although the weight of the opinion at the present time seems to favor the assumption that carcinomatous change does occur in papillomata. Sufficient clinical data have been adduced to support the view that such changes take place, and Mandelbaum¹ describes a specimen that seems to us to offer conclusive evidence of the possibility of such transformation.

Our own material has yielded us ample clinical and pathological corroboration of our view that a metamorphosis of papilloma into carcinoma does occur. Furthermore we are of the belief that such a change takes place very frequently and could be demonstrated in at least thirteen out of our fifty-two cases of carcinoma, namely 25 per cent. Some of the most instructive of our specimens are those obtained before the year 1910.² At that time almost all of the tumors of the bladder were at once subjected to suprapubic cystotomy and total excision so that in these a thorough examination of the mode of origin of the carcinomatous change could be carefully investigated. From our specimens we

¹ Surg. Gynec. & Obst. 1907, v. 115.

² Through the courtesy of Dr. Mandelbaum, Director of the Pathological Laboratory, Mt. Sinai Laboratory, photomicrographs of two of his specimens could be reproduced here. See Figs. 13 and 14.

³ Since 1910 many cases have been treated with the high frequency method so that minute pieces derived from bladder washings or specimens excised through the cystoscope represented the only material sent to the laboratory in many instances.



Fig 17

Fig 17 General appearance of papilloma (Case 10, changed papilloma Type II)



Fig 18

invasion of stroma with atypical cells — carcinoma above unaltered papilloma cells



Fig 19

Fig 19 Changed papilloma, general structure of papilloma (Case 41)

were able to conclude, first, that carcinomatous change in a papilloma is possible and does occur rather frequently, second that this change occurs in accessible portions of the tumor, that is not in the "depth," as has been generally assumed to be the case, but anywhere in the surface or in the deeper parts of the villi, third, that in the early stages the villi alone may be involved, fourth, that villous changes may be accompanied by infiltration, by invasion of the deeper parts, or by metastases in the capillaries, fifth, that all stages in the transformation of a papilloma into carcinoma can be followed in the various

specimens up to the point of complete transformation or even to the stage where an infiltrating carcinoma involves all the coats of the bladder-wall

We have been able to group the various changed papillomata into six groups, depending upon whether, first, epithelial changes alone were present (Fig 12a), second, where changes in the cells together with infiltration of the stroma coexist (Fig 12b), third, where extensive cellular changes with invasion of the capillaries of the stroma could be found (Fig 12c), fourth, where there are surface changes in cells, cellular changes in the stroma, and



Fig 20

Fig 20 Atypical changes in cells in same case (41), squamous metaplasia, taken from near surface, sufficient for diagnosis of carcinomatous change



Fig 21

Fig 21 Invasion of capillaries with carcinoma cells, same case (41)



Fig 22

Fig 22 Changed papilloma (Case 46 Type V), above and to the right, mucous membrane whole surface changed into carcinoma except for Island P which is still unchanged papilloma

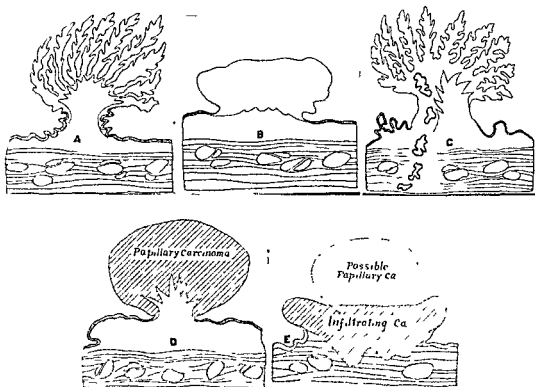


Fig. 14. a, schematic drawing of a papilloma, b, schematic drawing of a sessile papilloma, c, schematic drawing of an infiltrating papilloma, d, schematic drawing of a papillary carcinoma, e, schematic drawing of an infiltrating carcinoma.

nests of cells in the pedicle (Fig. 12d), fifth where extensive surface epithelial changes, slight foci of invasion into the pedicle, could be found (Fig. 12e), and finally, sixth, where there are surface changes with distinct carcinomatous change in the periphery of the growth the pedicle and the stroma being intact (Fig. 12f).

These six groups must not be regarded as distinct varieties, for a change from one type into another may occur as growth progresses. The classification is to be accepted rather as a schematic grouping that may aid in elucidating the chief arguments contained in this paper.

In Case 52 (small growths removed by Dr. Ware July 20, 1906), we have a specimen with the general structure of a papilloma, but with the evidences of epithelial transformation and carcinomatous change

in the deeper layers of the villi. There is extensive change near the surface of the growth extending downward for considerable distance, but always removed from the pedicle. Figure 13 shows the type of these changes in the villi. Figure 14 shows at 7 o'clock the distal portion of the pedicle in the center, the area of carcinomatous change shown in Fig. 13. Diagrammatically, this case is depicted in Fig. 12a.

A study of this particular case would lead us to conclude, first, that carcinomatous changes occur anywhere in the epithelium certainly in portions accessible and far removed from the pedicle, second, that they may occur in several places at the same time, third, that portions excised through the operating cystoscope would have been adequate to make a positive diagnosis.

Illustrative of the second type, in which changes in the epithelial cells are associated



Fig 23



Fig 25



Fig 26

Fig 23 Infiltrating papilloma, a, papilloma somewhat compressed owing to poor fixation of specimen, b, mucosa, c, muscle coat, d, islands growing through wall

Fig 25 Polypoid variety of papillary carcinoma (Case 39) macroscopically simulating papilloma, a, in

filtrated pedicle b, mucous membrane, c, any portion typically carcinoma

Fig 26 Polypoid (Type carcinoma I) carcinoma (Case 6) simulating papilloma

with infiltration of the stroma, the pedicle being uninvolved, we have Case 43

CASE 43 (J B) Here, too the topography is that of a papilloma (Fig 15), but many places are occupied by atypical cells. There is also deep invasion (Fig 16). Here it is difficult to differentiate between a papilloma which has become changed into carcinoma in many places, or primary carcinoma of the papillary variety with rather typical structure. The general appearance of such tumors could be that of papilloma with very few lesions in the stroma the changes being especially marked near the surface. The diagnosis could be easily made cystoscopically by the operating cystoscope although the general topographic appearance would be misleading. The value of atypical cells here too, will play an important rôle

Another example of the variety of changed papilloma is Case 10. Here we also have a small tumor with the general conformation of a papilloma, with a pedicle and without any considerable invasion of the pedicle

Material was obtained by complete excision of the tumor in a case in which a papilloma had been removed in the year 1906. Carcinomatous material obtained July 21 1909, was therefore, a recurrence. The general topography (Fig 17) was that of papilloma with a distinct pedicle, but in the surface epithelium there were distinct evidences of atypical cells deeply staining cells large atypical nuclei, disordered grouping of the cells, the general arrangement being almost everywhere that of a papilloma. It is interesting to note that in some places no atypical cells are present which points to the advisability of examining considerable material. After careful search several places were found in

which nests of cells had found their way into the stroma, and there were certain isolated cells and strands of cells of the squamous type in the connective tissue (Fig 18). This again bears out the reliability of assuming that atypical cells mean malignancy

Summary A tumor resembling a papilloma, which even on high-power examination of a large part of it shows typical papilloma, but which, on more careful examination, discloses atypical cells and distinct places of infiltration. The diagnosis could have been made on the atypical cells. The proof that we are dealing here with a carcinoma is found in the fact that there are a number of places in which atypical carcinoma cells can be seen in the stroma. Some of these are of the squamous type. From this the conclusion can be drawn that sometimes squamous-celled carcinoma may arise in metamorphosed papilloma

An example of the third type of changed papilloma is Case 11 (J S). Here we had a well pedunculated tumor, with no macroscopic evidence of any tumor in the depth or in the stalk. However there were markedly anomalous cells. In a number of places further evidence of the malignant nature of this growth was obtained in the presence of capillaries filled with atypical cells

Summary General topography of a papilloma, evidently carcinomatous change in a papilloma, the diagnosis corroborated by finding of invasion of the capillaries



Fig 27

Fig 27 Another portion of polypoid carcinoma (Case 6) exquisitely a mucosa and submucosa growth a mucous membrane b muscular coat, c, carcinoma



Fig 28

Fig 28 Infiltrating carcinoma (Type carcinoma II



Fig 29

Case 35), a mucosa, b carcinoma margin, c, muscular coat

Fig 29 Metastases of papillary carcinoma in mucosa of bladder

Another interesting example of the third type of changed papilloma is Case 41 (G L). Here was an exquisitely papillomatous growth of small size in which the diagnosis could have been made from any portion of the surface of the growth

Figure 19 shows that the general conformation of the growth is that of a papilloma. Microscopically there is no invasion of the deeper parts the neoplasm being altogether a surface growth. In the surface of the growth there were carcinomatous villi that could be mistaken for the villi of a true papilloma if the cells are not carefully studied. Figure 20 illustrates the atypical changes in the cells the squamous metamorphosis characteristic of carcinoma and rarely found so atypical in true papilloma. This is also taken from near the surface of the growth. Figure 21 exemplifies how the capillaries in the depth are invaded by the cells that have acquired carcinomatous character

Summary General appearance of papilloma, no macroscopic deep invasion but undoubtedly carcinoma as shown by the deep invasion microscopically invasion of the blood stream changes in the cells, in all probability a changed papilloma

Another interesting case of changed papilloma and one which belongs to the fourth type is that presented by Case 2 (N S)

Here we also had a papillomatous growth. Although it had the general conformation of a papilloma and was mistaken for papilloma in the examination of certain specimens removed from the surface, our recent studies have shown that these very specimens contained sufficient evidence of malignancy

to have warranted the diagnosis of carcinoma. There were enormous nuclei and an atypical arrangement of cells in the stroma features which were overlooked at the examination made June 12, 1911. Autopsy confirmed the diagnosis of carcinoma, extensive infiltration having been found in the depth and capillaries invaded with atypical cells

Summary Tumor with the general topography of a papilloma, evidently carcinomatous degeneration of a papilloma. Atypical cells and infiltration of the stroma should have led to diagnosis of carcinoma

An extremely interesting variety of changed papilloma is the fifth type

Case 46 Here we see practically the whole surface of a pedunculated growth converted into carcinoma only a few islands of papilloma remaining, as depicted in Figs 22 and 23

Illustrating the variety of changed papillomata (type VI) we have Case 48 (G N April 1906) a growth in which but a small area of carcinoma could be found (Fig 124)

Here we have a very small surface papilloma without any apparent involvement of the muscularis showing near its periphery the development of either a primary papillary carcinoma or a change in the papilloma itself. Where we see atypical cells we also find a corresponding infiltration of the deeper tissues

In addition to the changed papillomata just described we will give a brief account of the five others

Case 22 (L S April 24 1912) Another case belonging to the second type of changed papilloma

lomata. The preliminary diagnosis was incorrect, but on the criteria of 1913 the diagnosis could easily be made. Figure 10 shows not only the changed areas in the papillomatous portion of the tumor, but also the atypical cells, the infiltration of the stroma, and the villi with the squamous type of cells. From my studies of this case we would regard this as evidencing a carcinomatous change in a preexisting papilloma. In the course of time a portion of this became metamorphosed into squamous type of carcinoma, with subsequent infiltration of the stroma and the villi.

CASE 7 (O F, 1905, 1907, 1912), papillomatosis with change into carcinoma in the specimens removed in 1912

CASE 13 (J. J., 1905, 1911, 1913, 1914). Case of papillomatosis with carcinomatous change in a papilloma and metastasis in the suprapubic scar, the original vesical tumor having been cured by operation (Dr. E. Beer).

CASE 27 (I Z, 1913) Papilloma changed into papillary carcinoma, also infiltration with squamous type of cells

CASE 34 (J N, 1914) Typical carcinomatous change in a papilloma, reported as papillary carcinoma

CRITIQUE OF THE EXISTENCE OF CHANGED PAPILLOMATA

Our thirteen instances of carcinomatous changes in a papilloma will be open to the criticism that we cannot in every case prove clinically that papilloma existed for a long time before carcinomatous change took place. In most of the instances the pathological data seem to us to be sufficient to assume that such a change had taken place, nor need we accept only such to be carcinomatous that recur after operation or metastasize, for, given a tumor in which early changes have taken place, and an extensive or thorough operation done, why need we expect a recurrence or other clinical manifestations of malignancy in every case? Do we expect such an issue in carcinoma of the breast or other regions? Certainly such proof is not at all necessary. As for the previous history, one case gave a history of papilloma growth for more than seven years (Case 7), another for over three years (Case 10), another case (Case 13) for over nine years. In these a previous diagnosis of papilloma had been made on a number of occasions. There are a sufficient number of cases reported in the literature where a tumor had been observed for even more than ten years by competent men, and

PATHOLOGY AND CLINICAL COURSE IN CHANGED PAPILLOMA Papillary Carcinomata

No	Name	Pathology	Clinical Evidences
2	N S	Small tumor, infiltration	Autopsy confirmation
7	O F	Papillomatosis, carcinoma	Clinical confirmation
10	P P	Recurrence of papilloma	Not followed
11	J S	Early carcinoma infiltration	Operation
13	J J	Papillomatosis	Metastases
21	L S	Surely carcinoma	Operation — autopsy
27	I Z	Surely carcinoma	Clinical course and autopsy
34	T Mc	Carcinoma	?
43	J B	Carcinoma	Extirpation with prostatictomy
44	D M	Doubtless carcinoma.	Operation autopsy
46	G S	Certainly carcinoma	Hard tumor at operation
48	G M	Typical papillary carcinoma in periphery of sessile papilloma	Clinical confirmation
51	L E	Surely carcinoma	?

Summary. Of 13 cases of changed papilloma 10 cases were confirmed by other data

then a change into carcinoma took place. Our own cases leave no doubt as to the occurrence of this metamorphosis.

In short, although every one of the cases that we regard as manifesting a carcinomatous change in a papilloma could not be proved clinically malignant, a sufficient number (ten out of thirteen) were shown to be carcinoma either at operation or at autopsy to warrant the assumption that every one of the cases reported belongs to this group. A reference to the accompanying table will make clear that other data indicative of the carcinomatous nature of these changed papillomata could be adduced.

It may be urged that when a papilloma possessing all the changes described is present, and there is a carcinoma growing in the stroma, we must consider several possibilities: first, carcinoma developing from the papilloma; second, carcinoma developing from the bladder independently and secondarily invading the papilloma, and, third, carcinomatous metastases.

It is the first possibility that we have accepted in every one of our thirteen cases.

The question of the invasion of papilloma by a carcinoma developing independently could be ruled out in all the instances by a careful histological study. As for the possibility of metastasis, in the three cases of metastases that have been thoroughly investigated, we were dealing with a secondary growth from the prostate, or an adenocarcinoma from the sigmoid.

In fact, in our opinion the number of changed papillomata is in all probability much larger than that given here. In the laboratory we often get material from the deeper layers alone, the surface of the growth having become necrotic, having been possibly treated with the high-frequency method. Under such circumstances we can say nothing regarding the presence of a papilloma at some previous time and the possibility of a changed papilloma cannot be ruled out. We believe that a larger number of changed papillomata into carcinoma exists than recorded here.

INFILTRATING PAPILOMA

There is a type of malignant papilloma which occurred once in our one hundred thirteen specimens and which is the only one that could present marked difficulties in diagnosis. Characteristic of this type of growth (Fig. 23) is the fact that the general architecture is that of a papilloma, and that the cells may show no appreciable variation from the papilloma type. The tumor, nevertheless, infiltrates, the villi invading the submucosa and muscularis, even penetrating as far as the peritoneal coat.

CASE 29 (J. C.) presented two distinct papillomata 1 cm. in diameter near the sphincteric margin. In the posterior wall there was a sessile growth about 3 cm. in diameter. Both of the small tumors were histologically typical papilloma (Fig. 24a). The growth on the posterior wall was found on histological examination (Figs. 23 and 24c) to have penetrated all the coats of the bladder wall.

Several questions arise as to the diagnosis in such a case. Can we diagnose this type of papillary carcinoma or malignant papillomata in which the cells do not vary appreciably from the papilloma type, which infiltrates and is, therefore, malignant? Perhaps this is the only variety in which cellular abnormalities could not be recognized. What are the features upon which a diagnosis

could be made here, and how much material do we need? On looking over the specimens, we find that we do not have to go far to find large areas of muscle intervening between the epithelial islands. We need only enough material to show larger strands of muscle. Up to the present writing I have never been able to find larger areas of muscle between the villi of a true papilloma. If such are present, we can at once conclude that we are dealing with an infiltrating growth.

CARCINOMA OF THE BLADDER

B. Of our series of fifty-two carcinomata, forty-five may be regarded of the papillary variety, five squamous-celled, and two metastatic. There were at our disposal several other cases of carcinoma that could have been included in our list, but the material was not very large in amount, so they were discarded. There were several other cases of metastatic carcinoma secondary to primary growth in the prostate and one metastatic growth of the adenocarcinoma variety secondary to tumor of the sigmoid.

The enormous preponderance of the papillary variety of carcinoma is perhaps due to the fact that we have included under this type of cases all those tumors in which the cellular element and the disposition of the cells make it appear to us that they should be classed in this group. The following tables indicate how all the material may be subdivided.

BLADDER TUMORS

Papilloma	55
Carcinoma	52
(a) Papillary	45
(b) Squamous	5
(c) Metastatic	2
Sarcoma	6
Total	113

PAPILLARY CARCINOMATA

	Classified	Total
Early changes in papilloma	13	1 = 14
Completely changed	2	2 = 4
Primary carcinoma	16	9 = 25
Infiltrating papilloma	1	1 = 1
Material inadequate	1	1 = 1
	33	12 = 45
Papillomatosis	2 cases (included above)	
Total	52	52 carcinomata
Papillary carcinoma	45	45 = 86 per cent

PAPILLARY CARCINOMA

These may be classified according to their gross characteristics or according to their histologic structure. For the pathologist who wishes to be able to express a reliable opinion upon the nature of these neoplasms it is essential to know not only the minute changes and appearances under the microscope, but also the general topography, so that he can properly interpret the relation that these tumors bear to papilloma. Macroscopically we distinguish two varieties: the papillary polypoid type with its exquisitely intrusive growth, and the infiltrating type.

It is the polypoid or intrusive variety of papillary carcinoma (Figs 24d and 25) that is apt to be mistaken by the cystoscopist for papilloma. In our series, these growths were met with four times, although the second type or infiltrating variety may primarily have been carcinomata of this group.

The second or infiltrating type of papillary carcinoma is characterized by a more extensive surface growth, a total absence of stalk or pedicle, infiltration of the mucosa, later of the muscularis and subserous coat, very frequently by an ulcerating surface and the deposit of phosphatic material on the surface (Fig 24c). Twenty-five such carcinomata were found in our series, although it must be admitted that some of these may have originally belonged to Type I, the polypoid portion of the tumor having been either artificially destroyed or having become spontaneously necrotic.

The polypoid variety. The general appearance of some of these growths is that of a papilloma with a rather broad pedicle. Most of these are not diagnosed by the cystoscopist being mulberry-like growths of varying size.

One of the most interesting of these was Case 39, the general appearance of a typical papilloma, 2 cm in diameter, overhanging a broad pedicle (Fig 25). Surface shows the typical lobulations as in mulberry papillomata. The tissue is soft. Histologically the diagnosis of carcinoma was made on the presence of the atypical cells. The pedicle is free for the most part except in a few places where it is beginning to be invaded.

The question arises as to whether this was primarily a carcinoma or not. One gets the impression

that it may originally have been a papilloma. This patient was treated for some time by the fulguration method.

A sort of transition group is presented by those tumors which present polypoid growths in part, infiltrating in others. Some of these may also have originated in papillomata, although it is difficult to determine whether or not this is the case.

CASE 6 was a case of large mushroom like growth over an inch in diameter. In parts there were discrete polypoid masses of Type I variety (Fig 26) having a distinct pedicle. For the most part, however, there was a fungiform growth, with overhanging margin, as seen in Fig 27. Portions of this tumor could be interpreted by the inexperienced as papilloma. The deeper portions are distinctly alveolar carcinoma of the papillary variety. The bladder wall is scarcely infiltrated.

Most of the tumors of the first type and of the type here which shows the combination of Type I and Type II, demonstrate conclusively that carcinomata, too, are for the most part surface growths and thus become accessible to our methods of biopsy. In diagnosis, the proper weight must be placed upon the cellular changes, to correctly interpret the tissue on the surface as belonging to carcinoma.

When we come to the second type of infiltrating growth we may find little or no evidence of ingrowth into the muscle. Figure 28 shows the margin of such a growth, the mucous membrane being intact over a part of its periphery, the carcinoma having involved the mucosa and submucosa and passing down into the muscle.

Histological characteristics of papillary carcinoma. In order to be able to differentiate the carcinomata from the papillomata, we must first and foremost be acquainted with those finer changes to which we have elsewhere referred. For the beginner the recognition of a small area of carcinoma and the differentiation from papilloma is an extremely difficult matter.

Histologically, we may distinguish several types of papillary carcinomata: first, those in which cells remain small, resembling very closely the papilloma cells (Fig 6), second, those in which the cells are of the large variety, considerable protoplasm and large nuclei, and, third, the papillary carcinomata in which the

transition into the squamous-cell type occurs. In this latter group there is evidently a metaplasia in the carcinoma itself, and we must not regard these as primary squamous-celled types of carcinoma.

The small cell type is seen in Fig. 6, where the resemblance to true papilloma is apparent. The richness of the chromatin and the tendency to infiltrate, at once stamp this as carcinoma. The small size of the cells is also often dependent upon the tissue in which they are growing, the cells infiltrating the muscle (Fig. 8) being of this type, while the surface growth presents many large forms. The large cell type is extremely common in the polypoid carcinomata, and is the easiest to recognize. Thus and the form with metaplasia into squamous-celled carcinoma cannot fail to be diagnosed.

Local metastases in papillary carcinoma of the bladder. Two types of metastases have been noted in papillary carcinoma, and vary distinctly from the variety found in squamous-celled carcinoma. They may be classified either as the hard or soft variety. The former was observed in Case 38, where there was a large infiltrating tumor of the trigonal and paratrigonal regions, which was histologically papillary carcinoma.

In the paratrigonal regions there were two mushroom like masses with a sharp overhanging border, apparently covered by intact mucous membrane somewhat irregularly oval in shape. They seemed to be independent of the primary mass that occupied the trigonal region. In the vertex of the bladder there were numerous mushroom like masses varying in size from a split pea to a large lima bean, one of these being 2.5 cm. x 1 cm. in diameter, with sharp margin apparently covered by intact mucous membrane and rising only some 2.5 mm. above the surface.

In short, characteristic of this type of metastasis is the presence of fungiform flat growths (Fig. 29) varying from the size of a split pea or smaller to a lima bean or larger, with overhanging margins, rather firm and consistent, made up histologically of carcinomatous tissue that lifts up the mucous membrane at the margin with a tendency to ulcerate over the surface.

The soft variety of bladder metastasis in papillary carcinoma resembles in every particular the polypoid carcinomata of Type I, except that they show a tendency to infiltrate the muscle very early in their development.

SQUAMOUS-CELLED CARCINOMA

Of the fifty-two carcinomata, five could be regarded as primary squamous-celled. This type must not be confounded with those papillary growths in which a metaplasia of the carcinoma takes place. These tumors are exquisitely of the infiltrating variety. Indeed, they penetrate so quickly through the muscular coat that they must be regarded as extremely dangerous to the patient. They may be likened to the carcinomata or so-called epitheliomata of the lip. The margin is sharp, hard, and gritty, so that when a piece is removed with the punch forceps we get the impression that we are getting a bite out of an apple or pear. The ease with which the jaws of the instrument cut through is in contrast to the sensation of elastic consistency afforded by other papillomatous tumors. It is due undoubtedly to the cornification and the peculiar chemical composition of the cells. The surface of these growths is usually ulcerating and covered with phosphatic deposit.

CASE 37 (S. P., 1914) was a typical growth of this variety, somewhat more than an inch in diameter. Characteristic further was the infiltration of the epithelium of the mucous membrane in the periphery for a considerable distance under the mucous membrane and the presence of numerous small metastases in the form of hard, lenticular infiltrations of the mucous membrane of the vicinity. A study of the mucous membrane in the immediate neighborhood of these growths will often show leucoplakia, the neoplasm doubtlessly originating in the metaplastic epithelium of the mucous membrane.

PAPILLOMA OVER A CARCINOMA

The appearance of papilloma apparently growing over a carcinoma of the bladder has been mentioned by certain authors who used this phenomenon as an argument against the possibility of making a diagnosis in some cases. Thus it is contended that, since a papilloma of considerable dimensions may proliferate over a carcinoma, the region of the true growth is not accessible to the cystoscopist. We have made a study of forty-five cases of papillary carcinoma with a view to investigating the truth of this argument. From our studies we can conclude that errors in diagnosis have probably been

made, and that when "papilloma" is said to occur over a carcinomatous growth it will show evidences of the carcinomatous changes seen in our own specimens. Some of our cases formerly thought to be papilloma on top of a carcinoma are now regarded by us as *carcinoma*, in view of the criteria that we have now accepted as establishing the diagnosis of malignancy. Some of these cases belong to a group of early carcinomatous change in papilloma, such as Case 18. Other cases that are reported as papilloma over carcinoma are often incorrectly diagnosed, because of the fact that tissue (from another tumor—a papilloma elsewhere in the bladder) has been sent to a pathologist. For, it will be remembered, that one or more papillomata in different portions of the bladder can coexist with a carcinoma.

PAPILLOMATOSIS

A most interesting type of cases is that which we group under the name "papillomatosis." Clinically, these often have a malignant course. We have been able to obtain material from three such cases, only two of which I have included in the list. For many years we find repeated recurrences of papilloma, soon involving a large part of the vesical interior, and finally carcinomatous infiltration is demonstrated, either by the finding of an infiltrating bladder tumor or by the presence of a metastasis in the scar after suprapubic cystotomy.

From Case 7 we were able to obtain material on several occasions from October 3, 1905, to October 16, 1912. All the specimens previous to October, 1912, failed to reveal evidences of malignancy, but on October 16, 1912, histological examination shows atypical papilloma with atypical cells from which, according to the criteria we have accepted, a diagnosis of papillary carcinoma could be made.

Summary Papillomatosis for many years, possibly more than five and as many as seven, finally carcinomatous change of one or more papillomata. Clinically the case was regarded as carcinoma in 1912, because of the presence of a large indurated mass that could be felt in the suprapubic region.

Conclusion A papilloma may recur frequently as papilloma, but many years later may show a carcinomatous change. Even if

a piece of tumor removed for pathological diagnosis is reported as papilloma in such a case, we are not justified in regarding this as final, because some of the tumors may be papilloma, and still one or more may have become changed into carcinoma. The histological diagnosis of papilloma in a case of multiple recurrences gives us no indication as to the severity of the clinical course. We have no means of determining in advance which cases are going to be cases of papillomatosis. When the diagnosis is made, we have before us the alternative of complete cystectomy or thorough curettage and cauterization of the bladder interior if no carcinomatous infiltration has as yet occurred.

In other cases, such as our Case 13, from which material was obtained from December 23, 1905, to October 5, 1914, the histological diagnosis was papilloma on a number of specimens. At any time, however, a carcinomatous change may occur, as was evidenced in the case, first, by the presence of a *metastasis* in the scar after suprapubic cystotomy, and, secondly, by the finding in some of the specimens of the usual changes in the cells that indicate malignancy.

The clinical course of such cases may be the following: multiple recurrences of papilloma which disappear after high-frequency treatment or Paquelinization, apparent cure of the bladder lesions after Paquelin cautery or high frequency treatment, including even the destruction of superficial types of carcinoma, finally, metastases or local inoculation due to the implantation of fragments into the wound may develop.

In a third case material received nine years previously (1906) showed papilloma and at the present time distinct evidences of malignancy in the recurrence, the clinical course in consonance with the pathological findings.

In short, cases of papillomatosis must be regarded as grave, for, sooner or later, carcinomatous change of one or more papillomata will be the outcome.

Concerning the previous existence of papilloma in cases of either primary carcinoma or changed papilloma. Careful review of all the cases of carcinoma shows that sixteen of these were undoubtedly preceded by papillomata, and that in three cases slight doubt exists, but all the evidence points rather in favor of the

previous presence of a benign growth, which would make a total of nineteen out of fifty-two tumors, or over 30 per cent. If we would exclude the three doubtful ones, we would still have a percentage of 30 per cent, or 30 to 36 per cent of the carcinomata preceded by papilloma. It seems to me that this percentage is too low in all probability, inasmuch as our data are not adequate to prove the previous existence of a papilloma in those cases where we are dealing with extensive growths, in those in which the diagnosis was made late, where the carcinoma has attained considerable size, and where the history is indefinite. Therefore we believe that at least 30 to 36 per cent in our series were preceded by papillomata, and possibly 40 to 50 per cent.

It is absolutely beyond our powers of diagnosis to foresee which of the papillomata will at some future time acquire malignant characteristics, which of the papillomata will recur, or which of the papillomata belong to that rare type of infiltrating variety that is in itself malignant. It has been shown that many papillomata never recur, and many remain permanently benign. It suffices, therefore, for us to discard all the papillomata from further investigation, inasmuch as it is quite impossible for us to learn anything more of their future biologic characteristics in any given patient. On the other hand, whenever either early changes of malignancy have occurred, or definite structural manifestations of carcinoma are present, we must be able to recognize these in order to intervene with proper surgical measures at once, early interference giving the only possible hope of cure for the patient.

The question arises as to whether sufficiently reliable morphological criteria can be recognized to distinguish the biologically malignant from the benign growth. Certain observations by a number of authors would tend to support the theory that a pathologic anatomical diagnosis is practically impossible.

If we pass in critical review the various statements according to which histological diagnosis was found unreliable, we would have for consideration in the main the following: First, a histologically benign papil-

loma was found to infiltrate and make metastases. Second, a histologically benign papilloma was found to metastasize in the scar after suprapubic operation. Third, a histologically benign papilloma was diagnosed from a specimen in the bladder washings, and the clinical course as well as the corroborative findings at autopsy proved the growth to be malignant. Fourth, histological examination of papilloma consisting of small pieces removed from the bladder, extension into the prostatic region and perineal sinus, found to be carcinoma. Our own studies have shown, regarding the first statement, that whenever metastases developed it was regularly possible to find certain carcinomatous changes in the papilloma which had brought this about. It seems that the cases reported in the literature were not thoroughly examined, the carcinomatous changes overlooked, or possibly another tumor examined which was really papillomatous and of benign nature. We have been convinced of the fact that typical true papillomata do not metastasize.

As regards the metastasis of benign papilloma in the scar, this has been explained upon two true theories: first, that the tumor in the scar reported as carcinoma developed independently because of the long duration of the sinus (in which case it should be of a different type of carcinoma than is usually found in papillary tumors), or, second, that cells are loosened at a suprapubic operation and implanted into the scar. We have had occasion to examine very carefully many of those cases in the literature in which previous diagnoses had been papilloma and carcinoma was found later in the suprapubic scar. On investigating slides from such a case, it was definitely ascertainable that some of the material gave distinct evidences of carcinomatous change. Doubtless such tissue gave rise to the "inoculation" growths.

That the material obtained from the bladder washings failed to show carcinoma is not convincing because it is difficult for those who do not appreciate the finer evidences of early carcinomatous change to make a diagnosis from small specimens, and secondly, because the presence of several tumors cannot be ruled

out, the washings possibly emanating from other really benign growths

As for the extension into the perineum, we have ourselves observed a case, and found, too, that a part of the primary tumor had become malignant

We could suppose on purely theoretical ground that a tumor bearing all the histological appearances of being benign could metastasize and become malignant. If this were the case, we would be dealing with a problem impossible of solution. Fortunately from our studies this is only partly true of one type of tumor, the infiltrating type of papilloma

III SPECIAL DIAGNOSIS

The various types of papilloma and carcinoma may be grouped as follows

1. Papilloma
2. Infiltrating papilloma
3. Papillomata with early changes into carcinoma
4. Primary papillary carcinoma
 - a. Papillary polypoid type Carcinoma Type I
 - b. Secondarily infiltrating carcinoma Carcinoma Type II
5. Primary squamous celled carcinoma
6. Secondary carcinoma
 - a. Infiltrating derived from papilloma
 - b. Squamous type derived from papillary tumors
 - c. Those derived from the prostate
 - d. Metastases from source outside of the bladder
1. *Papilloma* Its characteristics have been sufficiently enumerated. It is necessary to obtain a large part of the growth for histological examination. This can almost always be accomplished if the snare is used. In order to be sure that the peripheral portions of the growth have not become carcinomatous, we must excise the mucous membrane of the periphery with the punch forceps. In the case of the sessile (Fig 24b) type of growth the snare is usually not applicable, and we must resort to many bites of the cystoscopic punch forceps or the Young rongeur.
2. *Infiltrating papilloma* Here we are dealing with the most difficult problem in the

diagnosis of papillary tumors of the bladder. The presence of larger areas of muscle between the islands of epithelium points to the existence of infiltration. The diagnosis of malignancy can be definitely made upon this point

3. *Papillary tumors with beginning carcinomatous change* In this group there are six different types according to our fifteen specimens. These are diagrammatically represented in Figs 12a to 12f

If these are reviewed, a striking fact comes to light, that the first and the most extensive carcinomatous change occurs near the surface, and not in the depth, as has been previously supposed, the tufts always showing evidences of malignancy. The villi are markedly affected in all. If in Type II we disregard the changes in the villi, we would have to find the places where the stroma is infiltrated, and even this has occurred distal to the pedicle. If in Type III we should not recognize the extensive carcinomatous changes in the villi, we would have difficulty in looking for capillaries or small islands in the depth. If we disregard the cell changes in Type IV, we would also have to seek in the depth for corroborative evidences. In Type V the same is true, except that the invasion is not so far from the surface, and in Type VI, if we disregard the surface changes, we would have to find that area of the periphery which has become typically altered.

In short, the diagnosis of papillary growths with early carcinomatous change depends not so much upon the acquisition of a large amount of material as upon our ability to detect and give the proper dignity to the early morphological alterations characteristic of carcinoma, for these changes do occur, as has been pointed out, in the tufts in all the six varieties. In only two out of the fourteen growths were evidences of infiltration or tumor growths in the bladder musculature or deep down in the pedicle. On the other hand more common was the association of the atypical cells in the villi, together with infiltration of the stroma of the villi distal to the pedicle. This was presented in six cases, that is cases in which the infiltration of the stroma could have been demonstrated in

specimens obtained by the punch forceps or snare, because changes were found on the tumor side of the pedicle. In three cases, only changes in the superficial portions of the tumor were found; that is, in portions of the tumor distal to the pedicle.

In short, we see that in practically all of these early papillary growths the diagnosis can be made if the criteria are accepted and if a reasonable amount of material is obtained for microscopic examination.

4 *Primary carcinoma* In these we should find no difficulty in making a diagnosis, since any portion of the growth is absolutely characteristic. They present practically no difficulties to the experienced microscopist.

5 *Secondary carcinoma* First, those arising from papillomata and infiltrating the wall of the bladder are easily recognizable on sufficient material, second, the squamous type, which has been changed from a papillary carcinoma, can be diagnosed from a small number of cells, third, the secondary carcinomata from the prostate have small cells as a rule, or may be tubular carcinoma or adenocarcinoma, and the metastases may be of various types, depending upon their source. None of these should give the pathologist any difficulty in diagnosis.

In five of his cases Mandlebaum¹ was able to recognize that the vesical growth was secondary to a primary prostatic neoplasm, basing his diagnosis on the finding of a scirrhous or adenocarcinomatous type.

There remains for consideration the squamous type of carcinoma, which was represented in five cases. Cystoscopically these present a rather typical picture. These tumors are comparable to epitheliomata of the lip, and the structure under the microscope is similar.

¹ Loc. cit.

CONCLUSIONS

From a study of the pathology of one hundred thirteen tumors of the bladder, amongst which there were fifty-five papillomata, forty-five papillary carcinomata, five squamous carcinomata, two metastatic carcinomata, and six sarcomata, we were able to conclude that a differential diagnosis between papillomata and carcinomata can be made in almost all instances on a pathological basis.

Certain morphological criteria were accepted as indicating the existence or the acquisition of malignant traits in any given tumor. These criteria were found to be present in parts of the tumor that are accessible in so far as they can be reached by cystoscopic instruments and in so far as adequate portions can be removed for histological examination. The changes that are indicative of malignancy occur not as heretofore assumed, in the "depth," where they may escape our diagnostic methods, but manifest themselves, first, in the epithelium, not far from the surface, either with or without areas of infiltration.

A test of the morphological criteria proved conclusively that they are dependable and, if adopted, lead to correct diagnosis. Many of the other loosely accepted notions regarding the malignancy of papilloma *per se* were found to be fallacious. Only in one tumor out of one hundred thirteen was a papilloma found to infiltrate and still retain "normal" cellular characteristics.

In short, a reliable pathological diagnosis and the possibility of differentiating between carcinoma and papilloma depend upon our ability to obtain material and upon our ability to recognize the criteria laid down as indicative of malignancy for that the latter are present our series of tumors has definitely shown.

INDICATIONS FOR SURGICAL INTERVENTION IN OBSTRUCTION AT THE NECK OF THE BLADDER

A SYMPOSIUM¹

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STRICTURE OF THE DEEP URETHRA SIMULATING PROSTATIC OBSTRUCTION

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THE subject of prostatic obstruction is well established, and I think that any advances which we may make in the understanding of the various forms of obstruction at the vesical neck must come from a consideration of cases in which the symptoms may be those of an enlarged prostate and yet not due to this condition. In the perusal of my records of prostatic obstruction there is a small group of cases which stand out as errors in diagnosis, and it is of these cases that I desire to speak.

The case reports which follow are instances in which all the symptoms of prostatism were present and the physical examination corroborated the symptoms. In the instances here cited it was a perfectly natural mistake to make in view of the ages of the patients, their symptoms, and the findings. All of these patients were over fifty years of age, none gave a history of stricture, and in each instance the attending physician had made a diagnosis of prostatic obstruction from a rectal examination. I corroborated the diagnosis in each instance, but without employing all the methods of pre-operative study.

Aside from the details of the history which are essential those of prostatism with obstruction the chief features which led to the errors in diagnosis were the enlargement of the prostate by rectal examination and a residuum of urine in the bladder, established by catheterization or by percussion. In all of these cases the operation was imperative, without much time for study, and it was only at the time of operation that the correct diagnosis was made. In each case a median peri-

neal operation was performed, the stricture in the deep urethra encountered and divided, and the urethra beyond the stricture found to be dilated throughout the prostatic urethra to the vesical sphincter.

In each instance the dilatation of the prostatic urethra was sufficient to admit the thumb, and its dilatation was the cause of the apparent enlargement of the prostate; for examination of the prostate per rectum subsequent to operation shows the gland to have diminished considerably in size.

Before relating the details of these cases it is interesting to note that had these patients been operated upon for prostatic obstruction by the suprapubic route, the stricture might have escaped detection. In fact, such was the case in one patient upon whom another surgeon did a suprapubic operation. In this patient the prostate was noted as being much enlarged before operation. A dilated prostatic urethra was noted and two small lateral lobes or parts of them were removed. A suprapubic fistula remained for many weeks, and a stricture in the deep urethra was discovered later. An external urethrotomy and division of the stricture resulted in the closure of the suprapubic wound.

CASE 1. G. F. R., age 55, referred by Dr. F. N. Stevens, Somerville, Massachusetts, September 10, 1913. Patient denies venereal disease and states that about five years ago the stream began to come slowly, then gradually became smaller, that it has little force and there is dribbling for about a minute after the act. About two months ago frequency of urination became more marked, occurring nearly every hour during the day and three or four times during the night. The frequency

¹ Papers presented at the annual meeting of the American Urological Association, Baltimore, April 13-15, 1915.

remained the same until last week, when the night frequency became every hour. There has been a little pain during the act, no blood, and the patient states that the urine has been cloudy for two or three years. There has been a little loss in general condition due to loss of sleep. The patient complains of small hemorrhoid which he has had for two years. Patient consulted Dr. Stevens on account of the frequency and difficulty in passing the water. Dr. Stevens believed, from detecting an enlargement of the prostate and a residual urine which showed a cystitis that the patient had a prostatic obstruction.

Physical examination showed the general condition to be good with slight sclerosis. Heart action regular, sounds clear, no murmur, blood pressure 148. Local examination showed a varicocele on the left, and both inguinal canals weak with a slight impulse on coughing. Rectal examination showed each lateral lobe to be increased to twice normal size, the left lobe slightly larger than the right. The median raphe was present in the lower third of the gland, the surface smooth and boggy. Soft rubber catheters and coude fail to enter bladder which was finally entered by a bougie catheter No. 10 Fr. which met obstruction at the tip of the prostate as had the other instruments which failed to pass. A residual urine of eight ounces was removed. The bladder capacity was fourteen ounces. The urine examination showed no renal elements but had the character of cystitis. The phenolsulphonaphthalein was eliminated in eight minutes, and the percentage for one hour was thirty two.

Operation Charlesgate Hospital September 16, 1913. Ether anesthesia. A grooved staff was passed to a point which was supposed to be the tip of the prostate where it met obstruction. An external urethrotomy incision was made upon the staff. A dense, fibrous stricture was detected in the deep urethra. This was divided and the urethra in the prostate was found much dilated admitting the index finger easily. The vesical sphincter was dilated enough to admit the index finger to the bladder. The vesical surface of the prostate was found to be smooth, the bladder moderately trabeculated and without foreign bodies. A No. 32 Fr. self retaining catheter was passed from the meatus to the bladder and syphon drainage established. The catheter was removed on the eighth day. The perineal wound healed in fourteen days. The patient was seen March 10, 1915, and stated that he has been entirely relieved of his symptoms, passing water about three times during the day and none at night. The urethra takes a No. 30 Fr. sound. There is no residual urine, and the prostate is but slightly larger than normal and almost half as large as before operation.

CASE 2 McC. age 65. Entered the nerve service of the Boston City Hospital September 16, 1914. The doctor who sent the patient to the hospital had made a diagnosis of paralysis of the bladder. Upon examination the patient showed

no signs of any nerve lesion. He denied venereal disease and his only complaint was incontinence of urine for two weeks prior to admission. The patient was seen in consultation with the nerve service.

Upon physical examination the patient showed a much distended bladder by percussion, and rectal examination showed both lateral lobes increased to twice normal size. Both lobes were equal in size, the surface smooth and softer than normal. The diagnosis of prostatic obstruction was made and the patient transferred to the genito urinary service. The house surgeon failed to enter the bladder with any instrument, obstruction being met in the deep urethra and considerable bleeding resulted from the instrumentation.

Operation September 10, 1914. It was impossible to pass a moderate sized grooved staff into the prostatic urethra, and after a few attempts an external urethrotomy without a guide was performed. The urethra being "faced" a stricture in the deep urethra was obvious. With a finger in the rectum the stricture was divided by a small knife and found to extend forward about half an inch from the tip of the prostate. The stricture being divided the prostatic urethra was found so dilated that at first one had the sensation of having the finger in the bladder. The vesical sphincter would admit the index finger easily, being much dilated. The vesical surface of the prostate was smooth. There were no calculi present. With one finger in the rectum and one in the dilated prostatic urethra the prostatic tissue was found to be very thin—not over one fourth of an inch—and there was no prostatic tissue which could be removed.

A catheter was placed from the meatus to the bladder and the patient made an uneventful recovery. The symptoms subsided entirely. There was about one ounce of residual urine five weeks after operation and the prostate by rectum was very small suggesting an atrophied gland.

CASE 3. Man age 54, referred by Dr. George Farrell. Patient denies venereal disease. Has had "weakness of bladder" for twenty years. Ten years ago noticed increased frequency and difficulty in passing urine and was catheterized a few times. In bed for a few days. Since that time has had increased frequency and during past year urinated six to eight times during day and same at night. Three days ago complete obstruction. Dr. Farrell unable to get instrument into bladder until etherized and then a metal catheter No. 14 Fr. passed to bladder with escape of urine the obstruction being said to be in the prostate. Following this the frequency was twelve times at night and six to ten times during the day. There was pain when the bladder was full and also during the passage of urine. Blood had appeared in the urine off and on more marked during the past few weeks.

Stream starts with considerable straining. Dribbling for two or three minutes after the act. Past week has wet bedclothes at night. Urine dark and

cloudy for many months. Bowels irregular, has lost little if any weight, but is weak from loss of sleep and worry. Physical examination shows patient to be in fair condition, but weak. Pulse regular, high, good volume. External genitals normal, small hemorrhoids, no hernia. Both lateral lobes of prostate much enlarged outward and upward. Median raphe not present. Gland hard surface, smooth, not adherent to rectum. Operation advised.

Operation, October 7, 1910, Charlesgate Hospital. Grooved staff meets obstruction in membranous urethra near apex of prostate. Forced through into prostatic urethra, giving the sense of being in the bladder. External perineal incision. Finger introduced into prostatic urethra, which is found to be much dilated, being larger in circumference than the thumb. No line of cleavage of prostatic lobes could be found. Vesical orifice normal. Finger in rectum and finger in the wound shows prostatic tissue to be less than one centimeter in thickness. The prostatic urethra and vesical sphincter give the impression that the prostate has been removed. This dilated condition is unquestionably due to the stricture in the membranous urethra, the stricture being divided by the perineal incision. Bladder palpated and sounded for stone, none present. De Pezzer catheter and syphon

drainage established, wound packed with iodoform gauze.

On the perineum were two scars — one on either side of the median line — which connect posteriorly just in front of anus. It was learned that the patient was shot in the perineum when a youth, and this was probably the cause of the stricture.

Catheter removed eight days after operation, controlled water perfectly from the first. The perineal wound healed slowly, not closing for three weeks. The patient had no instruments for six months following, as he felt so well that he said he did not require treatment, being able to hold water all night and going but six times during the day.

On March 22, 1911, the patient was seen, and he complained of having passed water with slight difficulty for two days, although there was no frequency. Bougie No 17 Fr tight in deep urethra.

The patient came for dilatation, and in ten weeks the urethra was back to No 28 Fr and he was without symptoms.

During the past four years the patient has been seen occasionally, but on account of having had a chill following instrumentation four years ago he refuses to have any instruments passed. Except for the fact that the urine comes slowly, he states, on March 8, 1915 that he is free from symptoms.

DIFFERENT TYPES OF FIBROUS OBSTRUCTION OF THE BLADDER OUTLET AND THEIR TREATMENT

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IT is difficult to approach the subject of obstructions about the neck of the bladder with a clear understanding of all that this phrase implies, and seemingly it has always been, which is due apparently to a confusion of terms. It was so away back in 1840—seventy-five years ago—when Mercier made his still often quoted contribution on the "Causes of Retention of Urine in the Aged." It was still so in 1875, at the time of the extensive investigation of Socin. It was so when the exhaustive researches of Ciecchanowski were published in 1902. And it remained so after this memorable work, and remains so, to a certain degree, in the minds of many of our modern observers.

We are too familiar with the types of prostatic obstruction which are described as lateral, bilateral and median lobe hypertrophy, and for the treatment of this condition, the controversy between the merits of suprapubic and perineal prostatectomy has diverted attention from the consideration of other equally important conditions which produce obstruction around the neck of the bladder.

Ciecchanowski's conclusions, namely, the inflammatory and probably gonorrhoeal origin of most cases of prostatic enlargement, have been rejected by the majority of observers, yet the same author has set forth in clear terms much that is true, particularly in relation to the importance of inflammation as a principal and contributory element in the end result of obstructive prostatic and vesical conditions, and of course it is the end result that has the greatest significance in weighing the value of any operation. The peculiar importance that is given, on the other hand, to the mortality percentage, apart from other considerations, would convey the belief that surgical skill in operating bears a direct relationship to such mortality rate, whereas, in a certain percentage of cases, it makes little difference who operates, as there

are certain conditions that belong to the pathological and clinical history that have a much greater determining influence upon the surgical outcome, and this is brought to light by a proper analysis of each individual case.

I will not undertake to enumerate all of the important features that should determine a classification of cases. It is well known that an analysis based upon the size of the growth, the amount of residual urine, the activity of the urinary symptoms, affords a very inadequate idea of the gravity of a given case; and while these factors have some bearing upon the question of operation, they give no indication as to its magnitude or prognosis. We know that the condition of the kidneys is of great moment in connection with all surgical operations in any part of the body, but reaches a prime significance in operations upon the urinary apparatus. The involvement of the kidney is an important element in determining the prognosis of prostatectomy; moreover, a series of classified cases has a better prognosis in one stage of this malady than in another stage thereof. This is so self evident that it is mentioned only as part of an appeal to arrange the cases for discussion and report with a view to the considerations based upon analysis of the principal features belonging to them.

The phase of this subject to which I desire to give emphasis has reference to the structural composition of prostatic and vesical obstructions and its bearing upon the operative end result.

Generally speaking we have three types of prostatic enlargement, adenomatous, fibrous, and malignant. I shall confine my remarks to the adenomatous and fibrous types of prostatic growths.

In brief terms, we understand that the pathology of prostatic hypertrophy involves a more or less extensive overproduction of the glandular and intervening connective-

tissue elements of the normal histological structure which has been designated hyperplasia. It is a well-recognized fact that as the glandular or connective-tissue elements predominate, so is there in the former a softer, as in the latter a harder, growth of prostate. This variation is readily recognized, but it does not embrace that which I desire to classify as the hard or fibrous prostate. While there may be a difference of opinion in this respect, I deem it desirable here to denote as the representative example of different classes the extreme types of such, in order to make the distinction perfectly clear.

We have in the case histories of many prostates the indication of the existence at one time or another of inflammation. This may be due to a specific bacterial invasion, such as gonorrhoea of acute degree or low-grade chronic inflammation of the ordinary pyogenic organisms. It may be due to the trauma of a foreign body. It may be confined to the vesical cavity, in the form of a cystitis, when it may have no appreciable influence upon the composition of the growth inside of this viscus. But it may be submucous in location. In this case it is the cause of the reproduction of that essential inflammatory tissue, fibroplastic material. Now, this is not what results from a greater degree of connective tissue in the ordinary glandular enlargement, but of an essentially morbid tissue, the tendency of which is to encroach upon the pre-existent glandular structure, and, by eliminating most of it, preclude its further growth or development. From this is evolved what might be fittingly called the true fibrous prostate, so typical in its composition of characteristic density and material, and its presence has a most important bearing upon the technique of operation and upon the prognosis, or degree of success, thereafter.

From studying the pathological anatomy of hypertrophy of the prostate, we have learned of the predilection of glandular hypertrophy for the middle lobe, that the extension of its growth is in the direction of least resistance—upward into the bladder, and backward into the rectum, that the so-called capsular boundaries of such a tumor are

formed by the compressed and atrophied prostatic structure, and that in a soft prostate this affords a very helpful means of enucleating the part to be removed—the more so when the glandular element predominates and relatively less so when the connective tissue intervenes.

Now, the true hard or fibrous prostate is not, as some have alleged, a secondary or more advanced state of the first variety, but is a distinct and individual formation. It, therefore, is likely to grow in different portions of the gland and of the adjacent structures that have variable anatomical limitations, such as the sphincteric ring and the trigone; or, if they involve the middle lobe proper, the inflammatory degree being of such intensity that the glandular elements are excluded early in the progress of the morbid process, so is determined a small fibrous growth at this site. The degree of obstruction may be just the same from such a growth, be it lobular or concentric, as that of a much larger lobulated prostatic growth. Other clinical evidences of this variety are more likely to be those, I believe, which signify the so-called irritable prostate, characterized by an undue frequency of urination, of much greater activity at night, with small quantities of urine, in distinction from the progressively enlarging adenomatous obstructive prostate, with dilating bladder, until complete retention and much distention have ensued, causing nocturnal overflow in stead of spasmodic incontinence.

Whatever position we may take upon the question of the causative agency of inflammation of prostatic hypertrophy, *per se*, we must at least admit the important bearing that inflammation has upon all of those structures that are concerned in the production of the symptoms that demand relief—a super-added agency that must be reckoned with. It is this element that affects the activity of the symptoms, the facility of operating, and the ultimate result to be expected following operation. It is therefore a most important element to be weighed in the analysis of any case.

In the first place, as regards the clinical symptoms. Without inflammation there are

no clinical symptoms of prostatic hypertrophy until much mechanical obstruction supervenes. We frequently witness the dilatation of an obstructed bladder, until it is capable of retaining several pints of urine, before the patient deems it necessary to seek medical or surgical aid. How different it is, however, with cystitis. When the cystitis is present at any stage of the malady, then we have that train of symptoms which is identified by the name of "prostatism," but which is largely contributed to by inflammation of the bladder.

With this same element of inflammation extending itself further, leaving out entirely the remote effect upon the kidneys, we have a more deep-seated condition, a deposit of that fibroplastic material that characterizes inflammation beneath the mucosa. If this is localized in the region of the vesical sphincter, there may be a contracture of the neck of the bladder. If it is more generalized we are likely to have a permanently contracted bladder capacity. Both of these conditions may exist independent of or in combination with the true types of adenomatous prostatic hypertrophy, therefore both have a very important bearing upon the operative procedure and the result attained thereafter. When this inflammatory process is circumscribed, being confined to the limits of the prostate itself, in certain cases it is not difficult to understand how there is produced a hard and contracted body, owing to the deposit of fibroplastic material and the elimination of glandular substance which may form the small so-called hard prostate in the median isthmus or a circumferential deposit around the sphincteric orifice producing contraction in which latter instance it may belong to the class of stricture of the outlet, contracture or the circular type of prostatic obstruction. Therefore the small hard prostate, the prostatic type of contracture, and the prostatic variety of stricture are all allied to each other and are different degrees or variations of a similar pathological process.

So much for certain differences in pathology and clinical symptoms, and lastly, a very important difference is that which affects the ability to treat these various conditions

surgically. As has already been stated, and as is generally known, the soft or adenomatous prostate is easily removed, both by perineal and suprapubic approach, and the difficulty is in inverse ratio to its size. The fibrous prostate cannot be removed by enucleation, and attempt at such removal will lead the inexperienced surgeon into a tedious, unsurgical, and sometimes disastrous situation of lacerated structure, and unsatisfactory attempt at removal of the obstructing area — to be followed later by a cicatricial contraction which will leave the patient unrelieved, if indeed he is not carried off by a urinary infection or septic thrombosis and embolism.

I have had occasions to operate on account of complete retention of urine which proved to be due to a fibrous contraction of the bladder outlet following a previous attempt to remove a fibrous prostate. In such instances there has been found a tight ring at the neck of the bladder, in place of the normal elasticity. Of course this may have been present at the time of the first operation but it is difficult to understand how it could be overlooked. At all events, it is more apt to be a sequel to the removal of a fibrous growth than to one of the adenomatous variety. I have operated suprapubically some time after a strenuous undertaking at removal of a fibrous prostate perineally and have found that such attempt has occasioned so much laceration that the prevesical structures were invaded, with infection of the space of Retzius. There had resulted a perivesical inflammation and permanent contraction and limitation of the bladder and its capacity. It is these surgical enormities and I have had my share of them by priority as well as by succession that make us stop and think before proceeding aimlessly.

This type of prostatic fibrous intrusion should be handled according to its location and extent to be carefully observed previous to operation by deliberate cystoscopic study. When the obstruction consists of a distinct bar or bridge formation my early and late experience agree in favoring the galvanocautery incision through a perineal opening provided there be no intra urethral obstruction or peri urethral involvement so that the

way can be cleared by such incision without invading too deeply the prostatic structures. Unless proper consideration be given to this important point, the result of the procedure will be seriously impaired and a valuable technique discredited.

Some types of small fibrous prostate that are anterior to the urethral orifice may be better attacked by careful dissection through perineal incision. In these cases it is desirable to accomplish the removal of tissue, if possible, by submucous excision. It is furthermore important to have in mind the pathological formation of the condition attacked, because, being a fibroplastic deposit more or less diffuse around the bladder outlet, it is likely to invade the muscular tissue of the sphincter, which latter is already impaired and will perhaps be further enfeebled by removal of the encroaching structure. It is on this account especially demanded, in these cases of perineal operation that strict regard be given to the integrity of the external sphincter surrounding the membranous urethra, as it is upon this that the future bladder retention must rely. In entering the perineal body, incision of the deep structures should be made well behind the bulb and retraction forward should be facilitated by severing the central tendon. Exposure of the apex of the prostate is then accomplished, as in extra-urethral prostatectomy, and removal of the invading tissue carefully conducted — if possible, under the eye, and if not by deliberate excision, not by blunt enucleation. It is much better to make more than one incursion against the obstacle attacked than to forfeit anything by doing too much at one attempt at its removal. It is a matter of first appreciating the actual conformation or structural abnormality to be dealt with and then of doing enough with out the penalty of overdoing it.

Other forms of fibrous prostate which lie in the isthmus behind the urethral orifice, may be reached by suprapubic section. In these instances the undertaking should be

equally deliberate, and should be pursued under direct ocular inspection. Some of these cases may be successfully treated, when the internal urethral orifice is exposed to view suprapubically, by forced divulsion thereof to the extent of splitting the sphincteric ring. Some of the cases will be found suitable for galvanocautery incision through the suprapubic wound, when examination with the finger determines that such an incision will adequately open up the bladder outlet.

On the other hand, when there is a more extensive growth and irregular deposit demanding total excision, this is accomplished, as in the perineal operation, by submucous removal if possible, but in any case by cautious excision. At all events, it should be constantly remembered that the character of the tissue to be removed enhances the danger of laceration into the surrounding structures and the secondary occurrence of urinary infiltration, complicating the immediate and ultimate result to the detriment of both.

In conclusion, it may be stated that the clinical symptoms of prostatic or vesical obstruction are without a uniform anatomical basis, whether they occur in the old or the young. One of the anatomical bases is to be found in the deposit of connective tissue or fibroplastic material, at the expense of the normal glandular or muscular substance, when as a result of such deposit there occurs an official obstruction of the bladder, or if, on the other hand, a prostatic hypertrophy exists, causing obstruction, such mechanical interference is responsible for part of the symptoms, and after the removal of such obstruction the function of the bladder returns to normal, only provided that the wall of the bladder has not suffered marked permanent changes in structure. In a word age and mechanical obstruction are both important factors in influencing the degree of irremediable changes in the bladder wall, and the highest degree is reached when to the other influence is added a chronic inflammatory process.

PROSTATIC OBSTRUCTION WITHOUT HYPERTROPHY

By BENJAMIN TENNLY, M.D., F.A.C.S., BOSTON

SIXTY-FOUR cases, helpful in considering this subject, have been submitted by members of this society. For these I wish to express my thanks.

It is well understood by urologists that malformations of the prostate, both congenital and acquired, may produce obstruction to perfect emptying of the bladder before these deformities produce any increase in the size of the gland as a whole. We know that such obstructions with the usual sequence of symptoms do occur in prostates which are actually smaller than the active adult gland, but it is unfortunate that many practitioners still fail to realize this fact and delay appropriate advice and treatment because they find no mass projecting into the rectum. This has led to the acceptance of theories of vesical atony in cases where the atony or incompetence is only relative and in which the removal of an obstruction, which a sound bladder, reinforced by competent abdominal muscles, might overcome, would reestablish normal function.

It is true that our best operators report cases with and cases without the symptom complex of tubes in which an operation has been done without relief of bladder symptoms, and these are offered as evidence of an inherent paralysis of the bladder musculature. Other cases are reported in which an operation has completely relieved these bladder symptoms in patients as frankly tubercle. Doubtless these diverse results may have occurred in the experience of some of us and compelled us to choose between admitting an incomplete operation and accusing the patient's bladder of incompetence. The question of vesical atony, or paralysis of the musculature of the bladder, awaits a definite answer, but the appearance of trabeculation in a bladder has always seemed to the writer to indicate a hypertrophy of muscle to overcome resistance rather than a condition due to deficient nerve stimulus to the organ.

Congenital malformations of the prostate

are rarely described or even referred to. Lowsley has given a full report of a case of prostatic malformation in an infant of three and one half months, with references to cases reported by others. Cases have been reported by Bransford Lewis and others in which the obstruction was known to exist in early youth and must have been developmental if not congenital. With many well-known failures of perfect development in this region, it is surprising that so little is known of congenital prostatic deformities and malformations. It may be that some of the obstinate cases of nocturnal enuresis are merely the dribbling overflow of an over-distended bladder behind a deformed and obstructing prostate. I have found no record of any investigation of this point.

As to the age of patients with obstruction without hypertrophy, the earliest age for occurrence of symptoms among the cases reported to me was nineteen. Thirteen of the group of sixty-four cases had symptoms of obstruction before forty. I have no figures for comparing the time of onset of symptoms with those produced by hypertrophied prostates, but the time for operative relief can be compared with that for general prostatic operation. One per cent of 816 prostatic operations previously collected and discussed were operated on before fifty years of age, while 20 per cent of the cases reported to me were operated on before that age, and 30 per cent were operated on before sixty, as compared with 16 per cent of the general prostatic operations. Obstructions due to prostatic deformity may produce symptoms at any age, and it will be interesting to learn whether the younger men whom we relieve of symptoms by removal of their small deformities later develop a second obstruction through a general hypertrophy of the glandular tissue. If there is a method of dealing with these early and small deformities which will decrease the chance of a later hypertrophy, that method is worth considering.

A differential diagnosis between old connective tissue changes in the membranous urethra and obstructive changes in the prostate is almost always possible, but is sometimes difficult. The two regions are close together, and there is no symptom particularly belonging to either. Age gives a suggestion often misleading, for we see obstructing strictures in men of sixty and older, and prostatic obstruction in men of forty and younger. A previous urethritis or perineal injury does not insure the presence of stricture in the membranous urethra or guarantee against prostatic deformity. Instrumentation may be difficult, and residual urine may be present with either condition. The feel of the sound as it passes through the narrow area, the deviation of its tip to the right or left, and rectal touch while the sound is in the urethra, are all helpful and sometimes sufficient for our diagnosis. Fortunately, by the time we can use a cystoscope with ease, dilatation has removed one of the diagnostic possibilities and we have to search for the obstruction in the prostatic region.

Approximately one-third of the cases reported to me gave a history of previous gonorrhœa. This agrees with what others have reported. If the gonococcus ever plays any part in producing these minor obstructions, other organisms must be equally competent and more common. The infecting organism must be descending or hæmatogenous, and the close relation of the small but still enlarged glandular masses to the urethral mucous membrane suggests that the infecting agent may be brought by the urine in many cases if not in most. Stone in the bladder has been assigned a causative rôle, but when we find stone without these deformities, and deformities without stone, we must admit coincidence rather than cause and effect.

Prostatic obstruction without enlargement may be due to —

- 1 Dense layer of new-formed connective tissue below the mucous membrane and in filtrating the internal sphincter — the fibrous ring

- 2 The same process with chronic inflammation of the submucous gland tissue — the bar.

- 3 Hypertrophy of submucous gland tissue involving the suburethral or subtrigonal groups or both — the hypertrophy in miniature.

4. Connective tissue replacing the glandular below the internal sphincter muscle — the fibrous prostate

- 5 Congenital malformation

Clearly, the conditions here suggested do not call for the same treatment. When the obstruction is small and strictly confined to the region of the internal sphincter, it is possible to get good results by methods that do not apply to the general condition which we know as the small fibrous prostate. In this condition we are practically dealing with scar tissue which must be stretched or cut through or removed as completely as possible. Connective tissue with its tendencies to contraction, reproduction, and occasional hypertrophy is poor material for surgical work. A result which is satisfactory at first may be quite the reverse after a few months of neglect, and permanently good functional result, whatever the operation, depends on the patient's faithful attention to his sounds.

Of the sixty-four cases reported to me, forty six were operated on through the bladder and thirteen through the perineum. There were four deaths, three of which followed perineal section, but some of these cases were attempts to remove the hard fibrous prostate, and thus operation is often long and difficult. They cannot fairly be compared with a list of cases whose lesions were confined to the region of the internal sphincter. The results of the operative treatment of these cases were satisfactory in forty-seven, unsatisfactory in eleven, death in four, not given in two cases. Unsatisfactory results followed the perineal approach seven times, the suprapubic operation three times, and the Bottini cautery once.

A punch as suggested by Young, or a cautery as used by Chetwood, or some other method of applying heat, will destroy obstructions which are in close relation to the internal sphincter and give entire relief, but the obstructions extending down into the urethra call for more serious treatment.

My personal cases, with the exception of

urethritis, and their teachings today have been accepted by all urologists. Goldschmidt's first model consisted of a straight fenestrated tube which carried a lamp at its closed end. This was improved by a flat lamp introduced into the straight tube, parallel to the optic.

Recent investigations have convinced many urologists that the Nitze-Oberlaender with a Valentine lamp is preferable to the irrigation urethroscope, because the water pressure often causes the softer infiltrations of the urethral mucosa to disappear and only the coarser plastic changes to remain visible.

The view obtained from the use of the older urethroscopes was small, and great patience was necessary to interpret them properly, and this fact explains why so few urologists used posterior urethroscopy. E. L. Keyes, Jr., emphasizes the point that in theory, as in practice, the problem of retention is mechanical, the bladder neck, and especially the elevation of its inferior lip, is the important mechanical obstruction. Goldschmidt's instruments permit of cauterization of the vesical neck, but local applications cannot be made with the same. For moving forward and backward, and for lifting and lowering the cauterizer, his instruments are provided with a complicated set of screws which renders technique difficult and necessitates frequent repairs. A further disadvantage is that all instruments must be held in the median line where they run in an unchanged direction and that a change of the operating instrument requires the removal of the tube, as almost every instrument is fitted to a tube of its own.

Quite frequently the pains of dysuria bring a patient to us with cloudy urine, and some of these cases have swelling of the mucous membrane, granulations and polypi on the border of the internal sphincter of the bladder, or at any other place in the deep urethra.

In chronic prostatitis we see the walls of the prostatic urethra rigid and this rigidity does not disappear on pressure with air or water. Often berry shaped growths project into the urethra.

H. Wossidlo has published a report of a case of tuberculosis of the posterior urethra,

so that we readily see how accurate a diagnosis can be made with his instruments.

The bent tube of Wossidlo has received a slight turn at the convex side which gives a greater field of vision, so that a larger area can be viewed.

To enable one to use the urethroscope under a moderate air pressure and to gain a better distention of the urethral walls, a small tube has been attached through which air may be forced by aid of a bulb. The tube rises at its vesical end to a cone which occludes securely the orifice of the bladder. The drainage tube attached to the sheath permits a thorough irrigation of the field without a rapid filling of the bladder with the irrigating fluid, as is the case with the Goldschmidt instrument, where, when the optical tube is introduced, the liquid has no other exit than into the bladder. It is easy to wash away any blood that may interfere with the examination or treatment, and the picture becomes more rapidly clear. The latest model of the Wossidlo instruments is very simple, permitting, as it does, of the change of operating instruments with the tube always in place after once placed in the bladder and at the same time the instruments may be moved readily from their axis. Many different instruments can be used through the same tube, as a galvanocautery, galvanocautery knife, a curette, a sharp pair of tongs or scissors, needles, probes, sounds, etc. One directs the instrument toward the place to be operated upon by the aid of the optic, then removes the ocular, opens the cock on the shutter, and slides the desired instrument through the opening below the optic, and then the ocular is replaced. When the galvanocautery knife is used we recognize its action by the appearance of fine bubbles of gas, and then the burnt tissue turns white. Deep cauterization should always be avoided, as it is much better to repeat after ten days if it should become necessary.

I shall not at this time go into a detailed report of the cases in which I have used the Goldschmidt and Wossidlo urethroscopes, but will give you a few details regarding these instruments and their uses. The Goldschmidt instrument is constructed in a num-

ber of different models. The one I use is the posterior urethroscope with the galvanocautery attachment. Goldschmidt and others have used the cautery repeatedly on the same patient, and numerous incisions of the obstructing median lobe or obstructing bands have been made at different times. The delicate construction of the instrument is one of its most serious drawbacks. I have seen quite a large number of cases on which perineal or suprapubic prostatectomy had been performed and the retention and residual urine not entirely, or at all, relieved by these procedures, but in which one or more cauterizations with the Goldschmidt cautery relieved the residuum or retention. Sometimes after a prostatectomy, when made even by our best and most able surgeons, contracting bands will recur and residual urine result from this recontraction of the bladder neck. This condition I have seen occur after both perineal and suprapubic prostatectomy.

In using the cautery (Goldschmidt or Wossido, Jr.), bleeding occasionally occurs and obscures the field of vision, although if considerable care is used and strong pressure of the irrigating fluid secured this can be avoided. I have never seen any alarming hemorrhage take place, however. A large residuum can be reduced several hundred cubic centimeters even after a single cauterization in some cases.

The statements most often made by those opposed to the method, that it is unsurgical and that the repeated cauterizations leave the prostatic portion scarred and battered are not true of the procedure in the hands of careful operators. If used in all cases of prostatic obstruction, the method on the whole, is bound to be a failure. The contention that in those cases in which cauterization has been performed prostatectomy afterward becomes a necessity, because of infection and replacement of the cauterized tissue by new growth or the obliteration of the new channel by the enlargement itself, is well founded if this operation is used in cases which are not adapted to it.

In a recent article Dr. Young says

"During recent years I have appreciated more and more that there existed a group of

prostatic obstructions which could not be very satisfactorily tested by either perineal or suprapubic prostatectomy: the cases of inflammatory median bar formation or contracture of the neck of the bladder."

I have developed an entirely new procedure—the urethroscopic median bar excision by means of a special "punch"—which I have used since April 20, 1911, on about seventy patients with no deaths and with excellent results. This method makes it possible to perfect the result obtained, either by perineal or by suprapubic prostatectomy, in cases in which, by the contracture of the tissues after operation, slight obstruction is produced.

The instrument of Buerger is valuable for examination, and I wish it were possible to have the cautery feature attached.

A great instrument was brought into use when Nitze perfected his cystoscope. Obstacles which had seemed unconquerable surrendered, one by one, to his energetic and persevering will, until a result was attained which is so simple that the original problem appears to have been an easy one. Without relying on the achievements of others, Nitze worked independently and set up in place of unsafe and uncertain methods, which could be carried out only by masters in our profession, an easy, positive, and definite method of examination which has proved a blessing to sufferers.

ADVANCE IN ENDOSCOPIC METHODS

Endoscopy of the stomach, according to the method of Nitze, was later taken up by von Mikulicz, who also developed the exploration of the urethra with an instrument which made it possible to throw light into this canal. Oberlaender likewise advanced and improved this method, but in spite of his efforts he was unsuccessful in reaching a result which can be compared with that of illuminating the bladder. Goldschmidt says: "We are now able to know the exact normal or pathologic conditions of the bladder and the same may be obtainable for the urethra."

The old endoscopic experiments on the bladder and urethra by Desormeaux, which

were carried on still further by Grunfeld, consisted in nothing more than the insertion of the largest possible tube; over the inserted end of the tube, one portion of the mucous membrane of the bladder after another was viewed, as the tube was withdrawn, by the reflection of light through the tube from the outside. At the best, only such portions of the wall of either the bladder or the urethra could be viewed at one time as could be surfaced over the end of this small tube. This condition of affairs was changed, as far as examination of the bladder was concerned, when Nitze invented and applied a finely developed lens system, by the aid of which he could view a portion of the bladder many times larger than the inserted end of the instrument. Not all improvements in the last ten years were essential to the principles of the shape of the instruments, but have been usually applied to the electric technicalities of the lighting features of the different cystoscopes and urethroscopes. Excellent photographs of the interior of the bladder and urethra, attesting to the diligence and ingenuity of the photographer Kollman, have been made by the use of different appliances.

Goldschmidt started his experiments some years ago along the line of Nitze's lens system, and by hard work and close observation to detail he was able to solve the problem. By the use of cystoscopic optic and convex lenses of smaller diameter than the object to be seen he produces a wide field of vision. When such collective lenses are inserted into a lighted tube, the rays coming from the inner surface and end of the tube will be gathered by the lenses, affording a view of the interior, at the end of the optic. This picture can be enlarged through a convenient ocular, just as is done with pictures of relative objects in endoscopy.

Many trials were necessary before Goldschmidt was able to construct a practicable and simple instrument. In the progress of his work Goldschmidt used only living subjects and constantly adhered to practical methods. He used water as a dilating medium, instead of air or any of the various gases. While trying to produce the largest

possible expansion by strong pressure of the dilating medium, he found, much to his astonishment, that only a little dilatation was necessary to produce a uniform tube of the urethra which could be accurately viewed with his optical appliances.

THE GOLDSCHMIDT INSTRUMENT AND ITS USE

The instrument is so constructed that a stream of water can flow through the space between the endoscope and optic into the urethra and douche it out. The instrument ends vesically with either a rounded point or a bill-shaped point, and is inserted with a well-fitting obturator into the urethra, permitting cold or hot boric-acid solution to run from an irrigator into the water chamber. To douche out the anterior urethra only a slight pressure is necessary, but to douche out the posterior urethra it is necessary to raise the irrigator to about 2 meters above the pelvis of the patient. When the obturator is withdrawn, the optic is inserted, the water-chamber closed, and the electric cables are connected.

The form of the instruments is such that their insertion and handling for ordinary cases cause no pain, and all operations can be done with local anæsthesia. Bleeding does not often occur. Infection is reduced to a minimum by the continuous irrigation with boric-acid solution. The normal anterior urethra by physiologic dilatation is like a uniform tube, much like the inner walls of the arteries, complete and incomplete rings can be seen, and the uniformity of the mucous membrane is interrupted only by shallow papillæ and indentures, which are sharp cut, round openings, and when infected become enlarged and deeper and often appear diverticular. The mucous fibers are often firmly attached to the mucous membrane and cannot be dislodged by a strong stream of water in chronically infected urethras.

It is interesting to observe how man is able to open voluntarily the mouth of the bladder as soon as he chooses to empty the bladder. This method no doubt will be much used to diagnose causes of nocturnal enuresis, as direct observation of the act of urination can be secured.

By changes in the prostate many disturbances of urination take place, especially in cases of enlargement or distortion of the middle lobe. Goldschmidt says: "We often find that the sphincter does not close, but irregularly cleaves." Whether the posterior urethra acts as a reservoir in the act of urination was much discussed some years ago. If the mouth of the bladder closes completely, which as a rule can readily be seen by the aid of the instrument, it becomes easy to decide whether the sphincter is properly functioning. Many and varied causes of disturbances of urination and difficulties in the prostatic urethra can be analyzed by direct observation of urination.

In cases of enlargement of the so called middle lobe and the lengthening of that portion of the urethra between the colliculus seminalis and the entrance to the bladder, one can see when the patient urinates how this middle lobe is pushed forward and the lower wall of the prostatic urethra is pressed against the upper wall, and instead of a relaxation a contraction of the urethra takes place. The lateral walls of the urethra become changed from old infectious processes, and in comparison with a normal urethra appear granulated, hard, and inelastic. In the prostatic urethra are found many mucous accessories and polypoid tufts.

If the light is passed just into the bladder the internal sphincter can be seen and by moving the instrument one can appreciate the thickness of the lips of this orifice, any irregularity or thickening of the edge can also be observed very distinctly. The difference is particularly remarkable in cases of hypertrophy of the middle lobe of the prostate. The larger the lobe the more one is obliged to push the instrument inward until the protuberance of the sloping part of the

bladder is reached. As the window of the urethroscope is divided into half centimeters, one can ascertain the size of the sphincter's edge, which normally does not exceed 0.25 cm.

The neck of the bladder having lost all elasticity, every effort at evacuation of the urine is followed by convulsive movements of the prostatic and posterior urethra. These movements also accompany the passage of the contents of the bladder into the posterior urethra. The clear water used for irrigation becomes turbid, being mixed with the contents of the bladder by these movements of the urethra.

If slight bleeding occurs, the hemorrhage is washed away by the water which constantly flows through the visual field. The prostate presents in the field, and not only the anterior portion, but also the prostate, is seen in its entirety, as the tonsils are seen in the throat.

The operation of Bottini and Fraudenberg's modification thereof were performed in complete darkness and are not to be compared with the Goldschmidt or Wossidlo methods, by which a full view can be obtained. The diagnosis, even by cystoscopy, shows only the prostatic prominences in the bladder, while most of the protuberances which prevent the evacuation of urine are caused by projections of the prostatic gland into the prostatic urethra.

It is unnecessary for me to say that the Goldschmidt method is not intended to replace prostatectomy in any way, but I positively know that these methods will, if properly used, decrease the number of radical cutting operations the same as litholapaxy performed by a skillful operator has done away with the necessity of opening the bladder.

NOTE.—In this review of posterior urethroscopy I have quoted freely from the writings and observations of Goldschmidt, Wossidlo, Frank, and many others.

REMARKS ON THE CLINICAL TYPES OF PROSTATIC OBSTRUCTION AND THEIR SURGICAL MANAGEMENT

BY H. A. FOWLER, M.D., F.A.C.S., WASHINGTON

IN any comprehensive discussion of the indications for surgical interference in obstruction at the vesical outlet, it would be necessary in the first place to consider in detail the underlying conditions producing obstruction at this level, and to consider the character and degree of obstruction produced. It would then be in order to discuss the indications for surgical interference in each group of cases separately. When we consider the various pathological lesions at the level of the bladder orifice—lesions of the seminal vesicals, inflammatory changes resulting in contracture, deep urethral stricture, and papilloma, vesical growths at or near the sphincteric margin, and prostatic adenoma, abscess, tumors and sclerosis—which result in interference with urination and produce obstructive symptoms, we can readily understand that such an ambitious undertaking as that indicated would far exceed the limits of several papers and would really cover the whole subject contemplated in this symposium. The time allowed does not even permit a thorough discussion of the rôle played by the prostate in the production of obstruction or an outline of the indications for surgical interference in the different forms of prostatic obstruction. I shall therefore limit my contribution to this symposium to some remarks on the clinical types of prostatic obstruction and their surgical management.

Important as the other lesions are from the standpoint of diagnosis and the selection of appropriate treatment, it is nevertheless true that, in the majority of cases, obstruction at the vesical outlet is due to, or associated with, changes in the prostate gland, and that the application of appropriate treatment directed to the prostatic lesions is followed by the relief of the symptoms of obstruction. Any obstruction at the vesical neck results in vesical retention. This varies in amount from a few drams of residual urine to complete retention. As a result of

the obstruction there is also difficulty in voiding. This may be so slight as to be scarcely noticeable or it may so extreme as to dominate the whole clinical picture—marked frequency, urgency, tenesmus, hæmorrhage, etc. The degree of obstruction, therefore, is measured by (1) the degree of vesical retention and (2) the degree of difficulty in urination.

It is a well recognized fact that there is no constant relation between the degree of obstruction produced and the character and extent of the changes in the prostate. For example, a prostate weighing two hundred grams and another weighing twenty grams may produce the same degree of obstruction, the symptoms in one case are quite as marked as in the other. A man with a huge bilateral prostatic adenoma may have no residual urine whatever, and may present few or no other symptoms of obstruction, while another patient with only slight changes in the prostate, so slight indeed as to be detected only by a very thorough and searching examination, may present marked obstructive symptoms with complete retention of urine. It is abundantly evident from observations of this kind, which are not isolated examples, but are on the contrary supported by the experience of every genito-urinary surgeon, that the degree of obstruction as measured by the amount of residual urine and the difficulty of urination bears no relation whatever to the degree of enlargement of the prostate and gives us no clue as to the character and extent of prostatic involvement.

In reviewing my own experience, together with the literature relating to prostatic obstruction, it seems to me convenient for this discussion to separate these cases into several distinct and well defined clinical types which will embrace all the clinical forms of prostatic obstruction. The basis for this classification or grouping of cases must of necessity be the changes in the prostate as determined by

various clinical methods of examination. Vesical retention and the other sequelæ of prostatic obstruction are the conditions for the relief of which surgical interference is undertaken. These vary widely in different cases belonging to the same clinical type or group and, as we have seen, bear no constant relation to the form or extent of obstruction. But since the obstructive symptoms are always associated with and are produced, either directly or indirectly, by the changes in the prostate, the exact determination by clinical methods of the character and extent of these changes is essential to the choice of appropriate surgical treatment.

Adopting the basis here given for classification, we recognize four distinct clinical types of prostatic obstruction:

1 The prostate distinctly enlarged per rectum (prostatic hypertrophy, prostatic adenoma). This is by far the largest group and includes all cases of unilateral, bilateral, or median lobe enlargement in which this can be made out by rectal examination. The diagnosis is confirmed by catheterization, and the size and character of the enlargement can be further determined by cystoscopy when necessary or advisable.

2 The small sclerotic prostate. Rectal examination reveals the absence of a large, soft, adenomatous gland. Instead, the prostate is hard, firm, resistant but elastic. The size may be slightly increased or it may be quite normal or even atrophic. Cystoscopy is apt to be more difficult than in the large adenomatous variety. The irregularity at the sphincteric margin due to small projecting lobes, the elevation of the urethral floor with the bas-fond behind, and the rectal examination with the cystoscope in place make the diagnosis fairly easy.

3 Purely intravesical prostatic growths. These patients present the typical clinical picture of prostatic obstruction, but rectal examination reveals no enlargement or other appreciable changes in the gland. The diagnosis can be made only by cystoscopy. To this type belong the patients with wholly intravesical projecting lobes, either lateral or median, pedunculated lobes springing from the anterior commissure or lateral urethral

margin, and small isolated adenomata involving Albarran's group of glands or prostatic glands at the sphincteric margin.

4. Retention without apparent mechanical obstruction or demonstrable cord lesion. This is the most important group from the standpoint of differential diagnosis. These patients present the typical characteristic symptoms of prostatic obstruction, but examination fails to disclose any changes in the prostate to account for the vesical retention. Guyon first called attention to this type of case and referred to the condition as prostatism without hypertrophy — "prostatism sans prostate." In the absence of apparent obstruction at the vesical neck, various theories have been proposed to explain the retention and other symptoms of obstruction. It is unnecessary at this time to review the various explanations which have been suggested. It is sufficient to point out that there is an increasing tendency to regard the vesical retention in these cases as due to two, and only two, causes, either an unrecognized mechanical obstruction or a nerve lesion involving the center controlling the bladder or interfering with its innervation.

Unrecognized mechanical obstruction. Evidence of a convincing character is accumulating which tends to support the view that in these cases of unexplained retention the underlying cause can always be found in either a nerve lesion or an actual obstruction at the vesical orifice, so slight in many cases as to be easily overlooked by the usual methods of examination, and in some cases recognized only by direct palpation of the vesical outlet through the open bladder. The three forms of obstruction so far met with in this type of retention are contracture of the vesical outlet (Keyes, Chetwood), median bar (Young), and minute peri-urethral adenomata (Marion, Catarro). To these I would add small intra urethral projecting prostatic lobes. I have had under observation three cases of vesical retention in which rectal examination and cystoscopy failed to disclose any evidences of prostatic obstruction. The caliber of the urethra was undiminished, large sounds passed to the bladder with ease. Inspection of the posterior urethra showed

small well-defined prostatic lobes bulging into the urethra from the lateral walls and transforming the lumen into a vertical slit, quite as one sees in bilateral hypertrophy. The offending lobes certainly would have been overlooked in these cases except for the direct inspection of the prostatic urethra through the cystoscope during its removal. This examination of the posterior urethra should always be made when bladder cystoscopy fails to reveal an adequate cause for retention.

Nerve lesions. In every case of vesical retention without apparent obstruction the possibility of a cord lesion as the etiological factor must be considered. It is, I believe, a well established fact that the first, and perhaps for years the only, symptoms of tabes may be those referable to the bladder, symptoms indistinguishable from those due to mechanical obstruction. In the absence of other evidence of the disease, the diagnosis has not been heretofore always easy to establish. At the present time, however, the newer aids to diagnosis—the Wassermann test of the blood and spinal fluid and the protein content and cell count of the spinal fluid—have made it possible to recognize tabes as the etiological factor in many of these obscure cases.

The point of practical interest in this whole matter is this. With the means at hand of more accurately differentiating between these two forms of retention, the indications for surgical interference become more clearly defined. In cases of retention due to a nerve lesion and uncomplicated by mechanical obstruction, any surgical operation will be fruitless and may be worse than useless. Experience in the last two years has shown that in the other types of obstruction, where the etiological factor is so often difficult to determine by our clinical methods of examination, and is at times impossible to recognize except through a cystotomy wound, appropriate operative procedures have given most brilliant results. To avoid unnecessary and useless surgery on the one hand, and on the other hand to give these hopeless cases the relief which surgery offers, demands a careful differentiation of these two forms of ob-

struction based upon accurate pre-operative diagnosis; and to do this may at times tax the skill and judgment of the most accomplished genito-urinary surgeon.

Surgical management. Success in the surgical management of patients suffering with prostatic obstruction depends, in the final analysis, upon a complete pre-operative diagnosis—with extraordinary emphasis upon "complete." Obviously, the first step is to determine the character and extent of the obstruction. Upon this data is based the selection of the appropriate surgical procedure according to the individual operator's experience and judgment. Equally important is the determination of the patient's fitness to undergo an operation and the necessity for, and amount of, preliminary treatment required to assure a certain and quiet convalescence. It is hardly necessary to consider here the detailed steps of the various methods of examination leading to a complete diagnosis. These necessarily vary in different cases and in different clinical types of obstruction. But one cannot too often insist upon the importance of a thorough, careful, preliminary study of each individual case as a basis for sound surgical judgment.

In the first three clinical types of prostatic obstruction enumerated above, removal of the obstruction by prostatectomy is clearly indicated. Whatever may be the cause of the vesical retention in these cases, removal of the obstructing prostate is followed by complete relief of retention and the other obstructive symptoms. The perineal and suprapubic operations have now been standardized to such an extent that the operative technique differs only in certain details in the practice of different surgeons. The choice of operation will depend upon individual preference.

I do not wish to raise the question or to discuss the relative merits of the two operations. But it is my belief that the suprapubic operation adequately meets the requirements in every case when a prostatectomy is indicated. In the adenomatous variety of prostatic enlargement the removal of the obstructing adenoma is easily accomplished. The small, adherent, sclerotic prostate is

the most difficult variety to deal with surgically. It is in this class of cases that the perineal operation is supposed to present distinct advantages, particularly if the patient is large and fat. These are without doubt the most difficult cases for a prostatectomy by either method. But I am of the opinion that these difficulties are technically just as great by the perineal route as by the suprapubic, while the functional results obtained by the high operation are likely to be more satisfactory in a larger percentage of cases. This, I believe, is due to the more thorough and complete removal of the dense fibrous tissue surrounding the vesical neck in these cases, which produces a relative stenosis and an elevation of the floor of the urethral orifice.

If the indications for surgical interference are clear in the first three clinical types of prostatic obstructions, the surgical management of the last group, namely, the case without apparent mechanical obstruction or demonstrable cord lesion, presents greater difficulties. As already pointed out, many of these cases without apparent obstruction do, as a matter of fact, present changes in or about the vesical neck which are easily overlooked by the usual methods of examination. That these changes are sufficient to account for the vesical retention is evidenced by the fact that appropriate surgical methods directed toward their correction is followed by a restoration of the normal bladder function.

Relative stenosis of the vesical orifice in the form of contracture, or a median bar, has been found as the most common pathological condition in these cases of obscure retention. With the bladder opened above the pubis, a rigid, unyielding, contracted orifice is felt on attempting to introduce the finger into the prostatic urethra. The urethral opening is often elevated a considerable distance above the trigone. In one case the stenosis was so extreme that with the bladder opened above the pubes we noted a decided blanching of the mucosa about the orifice from pressure on introducing an ordinary silver catheter. The stenosis was relieved by removing with electric cautery a wedge-shaped piece of tissue from the floor of the outlet extending completely through constricting ring

The pathology of this form of obstruction is not well understood. The underlying pathological changes have not been sufficiently studied. And we are not able, therefore, to state definitely just what are the etiological factors responsible for these changes. Clinically, we recognize a stenosis of the vesical outlet in the form of a dense, unyielding ring of tissue, and it is generally assumed that these changes are inflammatory in nature and the result of a deposit of scar tissue. This assumption, so far as I know, is not based on any extensive histological studies. Additional study of a larger amount of material is necessary in order to clear up the question of the pathology of this form of obstruction and to aid us in the selection of appropriate treatment in individual cases.

In an important paper in the *Journal d'Urologie*, 1912, Marion has reported several cases of obscure retention in which the etiological factor was not demonstrable by the usual clinical methods of examination and was recognized only by direct palpation after the bladder was opened. He found minute peri-urethral adenomata to which he attributed the obstructive symptoms. The operative treatment employed by Marion, namely, the removal of the vesical neck, including the bladder sphincter, seems rather heroic, but the important point is that normal urination was reestablished.

Bransford Lewis, in an admirable paper, has reported recently¹ a number of cases of obscure retention observed by him. In two cases "contracture" at the vesical orifice was demonstrated and normal bladder function restored by incisions and dilations of the fibrous ring through a perineal cystotomy wound. Lewis, in common with many others, is "a partisan of the belief that urinary retention is occasioned by two causes only, namely, mechanical obstruction or nervous influences. If we do not perceive which of the two are in play, it is but an evidence of our human frailty in diagnosis."

In one case of intra-urethral prostatic adenoma I was led, for various reasons, to try fulguration in an attempt to relieve the obstruction. This was a very favorable

¹ *Am. J. Surg.*, 1915, March

patient, as he bore repeated instrumentalizations exceedingly well. The intra-urethral manipulations were difficult and tedious, but seven séances were sufficient to reduce a residual of three hundred cubic centimeters to zero, and all symptoms of obstruction disappeared. This patient has been under observation for one and one-half years, during which time there has been no return of his trouble. Encouraged by the results in this case, I tried fulguration in a second case of the same kind. The results were not so favorable. There was marked relief lasting eight months; then symptoms of obstruction recurred, and I was obliged to enucleate the obstructing adenomata through a suprapubic incision. Functional results, urinary and sexual, following the second operation have been perfect. The third case of intra urethral adenoma referred to was seen in consultation. Operation was deemed inadvisable, and patient died in three weeks of uræmia.

Several operative procedures have been employed in relieving the obstruction in

the group of cases now under discussion, varying with the character of the obstruction as determined by the clinical methods of examination, or palpation through the bladder. The discussion of the indications for and the results of Chetwood's cautery operation and Young's punch operation I leave to the distinguished authors of these operative procedures. Among the various other methods employed we may mention gradual dilatation, division with a knife or cautery and dilatation through a perineal cystotomy wound, excision of a wedge-shaped piece of the constricting ring through a suprapubic wound, removal of the vesical neck, including the sphincter, through a suprapubic opening, and fulguration. The operation of choice will of necessity vary with the character and extent of obstruction met with. Attention has been called to the need of further study of the underlying pathological changes in this form of obstruction as a basis for the determination of the best methods of dealing with each individual case.

CONTRA-INDICATIONS TO SURGICAL INTERVENTION IN OBSTRUCTION AT THE VESICAL NECK

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THAT surgical intervention is absolutely demanded in certain conditions of obstruction at the vesical neck goes without saying. Indeed, in many such conditions, for the practitioner to withhold it or discourage the patient from accepting it, is to deny him the opportunity of relief, contributing directly to both misery and mortality. But on the other hand, there are certain other conditions contributing to obstruction at the vesical neck that do not demand operative interference, and under such circumstances intervention of this sort should be viewed not only as middle-some, but as harmful and without compensating features.

No matter how varied, apparently, the causation of urinary retention, it is believed by the writer that it always arises from one

of two factors, physical obstruction of some kind or disturbance of the nervous mechanism controlling urination. Excluding the several forms and kinds of physical obstruction that habitually demand operative methods of relief, we have for consideration, as included in the retentions demanding non-operative methods, (a) those of congestive or inflammatory origin, (b) those of habit formation, and (c) those of cerebral, (d) spinal, (e) neurotic, (f) psychic, (g) reflex, (h) toxic, and (i) infectious (bacteriuria) causation.

a Congestive and inflammatory retention. We have all observed cases of difficult urination or even retention of more or less severity and duration of the first classification, chiefly in connection with inflammatory swelling of the prostate with or without coincident hypertrophy, and we have seen these clear

up and resume normal ease and completeness of evacuation on the disappearance of the congestive conditions. In connection with so-called hypertrophy of the prostate, refined judgment is sometimes required to say just how much obstruction is dependent on the hypertrophy and how much on the inflammation. I have seen cases in which I misjudged conditions and later had to revise an estimate, acknowledging the lack of necessity for operation that had before seemed imperative. Time, and quieting measures affording physical and surgical rest, will usually solve the question where there is doubt.

b Habit. Retention from a habit of unduly postponing urination, either because of modesty or from preoccupation, is said by certain observers to become serious and permanent (1). It has been reported as affecting teachers, clerks, and others of exacting occupation. While there is a difference of opinion as to the exact mechanism of producing this effect, there seems no doubt of its reality, and it is equally obvious that no operation is required for its relief.

c Retention of cerebral or spinal origin. Layton (*ibid*) remarks that partial or complete retention, for a variable length of time, is of more or less frequent occurrence in meningitis and myelitis, in the first stage of anterior poliomyelitis, it occurs early in some cases of either cerebral or cord hemorrhage, and has been encountered in lateral sclerosis and in multiple sclerosis (2). All are familiar with the chronic retentions of tabes and spinal syphilis. It will hardly be claimed that any operative plan is appropriate for any of these, and yet in a paper read by the writer a year ago before this association (3), it was related that several cases had been observed in which surgical assaults had been committed on just such cases, committed under the belief that they were cases of ordinary prostatic obstruction from hypertrophy or contracture or an indeterminate entity classed under the omnibus term "prostatic obstruction."

The lesson of these cases is to adhere more closely to refined diagnosis, and allow the diagnosis, correctly delineated, to dictate the character of treatment for each case.

The Wassermann tests are of vital importance in doubtful cases, and, as previously pointed out (*ibid*), will often throw a flood of light on a condition so obscure and mystical that it has been designated "unaccountable" by writers of note and large experience.

e Neurotic. The retention of hysteria, of emotional storms (Layton, *ibid*), of nymphomania, of fatigue (4), and masturbation have but to be mentioned to be excluded from operative methods of relief, except as they depend on some originating pathological condition that requires operation. They are practically in the same category as the next two classes, (f) psychic and (g) reflex, to which the same remark applies.

f The psychic form of retention, that from the influence of a fixed idea, is occasionally met with. Aldrich (5) relates the case of a girl who could not urinate except in a darkened room, and of a boy who could not urinate in a darkened room, but had no difficulty when in the dark out of doors. It is obvious that such a condition presents no indication for operation.

g Reflex retention. The urinary organs are a frequent prey to reflex nervous irritation, and its end-results are multifarious. An occasional one is urinary retention. Swinburne (6) mentions some interesting cases of this sort.

CASE 1. Patient had been operated twenty years before by a prominent specialist of that time (perineal section for supposed tight stricture). Ten days after going home, his condition was the same as before operation. Since that time he had been relieved by the use of sounds. On coming to Swinburne, the patient had four ounces of residual urine. Examination with the endoscope showed no narrowing and no stricture. A few applications of nitrate of silver through the endoscope relieved this to a considerable degree. At times the patient completely emptied his bladder, but if he went too long without treatment he had partial urinary retention.

CASE 2. Another case reported by Swinburne was that of a man 26 years of age, suffering from enuresis and having a residual of eighteen ounces. An inflamed posterior urethra was given as the reason. After application of silver through the endoscope to the verumontanum, the patient was greatly improved and had only eight ounces.

It is related that a surgeon prepared to operate by external urethrotomy on a case

of severe deep urethral stricture with marked impediment to urination. His orders included a brisk purge, which acted on the night previous to the time set for operating. The evacuations brought away a goodly number of ascarides vermiculares, the irritation of which in the rectum seemed to have been causing the urinary obstruction, as the latter was then found to be entirely relieved. The operation was not done.

Post operative acute retention is a matter of frequent observation, both in men and women. This pertains especially to operations on the rectum or pelvic organs. Retention often follows parturition. It sometimes follows the administration of general anesthesia, or the use of urethral instruments. The necessity of operating on a case of reflex origin depends on the primary cause of the reflected irritation. It may or may not require operation for relief. But at least it goes without saying that the retention deserves no direct form of operating for relief, and that therapy, whatever it is, must be directed to the original focus of trouble.

h Toxic retention. Various kinds and forms of toxæmia evoke urine retention. The following are the more frequent: alcoholism, uric-acidæmia, uræmia, acidosis, diabetic coma, puerperal sepsis, febrile states (typhoid), chilling of the body (7). The toxic effect of drugs (cantharides, turpentine, phosphorus [8]) is very similar to the above and is well established. It will be noted that these are all causes of retention not demanding operation for relief.

i Infectious retention. An exceedingly interesting condition, often producing retention in little girls, is that of bacteriuria. A fact that separates this from the inflammatory form, previously mentioned, is that it is effective for deleterious influence without any inflammation or suppuration being present.

The phenomena of bacterial infections of childhood have been studied by many in the past decade, notably Hirschsprung (9), Holt (10), Zahorski (11), Abt (12), and Joseph Brenneman (13). Following a colon bacillus invasion of the urinary tract a child may make no complaint, but may show marked indispotion and suddenly become unable to

void urine naturally. Examination of the urine drawn by catheter finds it loaded with colon bacilli, but often without any pus. The kidneys may or may not be involved in addition to the infection of the bladder. Pediatricians say that such infection is shown in fully one per cent of children's illnesses. No operation is required in such cases unless accompanied by some pathological condition that must be remedied by operation, but internal and local antisepsis with regulation of diet and intestinal activity usually afford success.

Atony. Atony of the bladder and its connection with retention of urine have been discussed elsewhere (3) more extensively, but it may be here remarked that the weakening of the walls and detrusor muscles of the bladder is an entity that bears on retention in a definite and contributory manner. But the writer does not believe it occupies as important a position as is usually ascribed to it, or that it is irremediable, as often accredited. He is further of the opinion that its relief depends on the removal of its cause, the obstruction.

Other conditions, such as advanced or marked debility, are considered by some to preclude operation where it would otherwise be highly desirable or even life-saving. This assumption must be qualified. As a matter of fact, it is very seldom that old age in itself precludes operation. Many cases over eighty — some, even, up to ninety — have been operated on successfully for prostatic obstruction. While this factor is one that cannot be corrected by time, it is also one to which by far too much attention is given by friends and relatives, and often also by the physician in charge. It is a fact, established by large experience, that old men whose physical condition is fair tolerate anesthesia and operation surprisingly well, if appropriate preparatory measures are fully carried out. Fortunately, the other factor, debilitated physical condition, is one that can be corrected in the great majority of cases by the various forms of preparatory treatment that have come into vogue of late years. An old gentleman who requires prostatectomy must be very far gone indeed, these days, to be

beyond reach of its beneficent influence. It is true that the presence of albumin and casts in the urine, or a valvular heart lesion, sound a note of warning, but they present no insuperable obstacle to surgical intervention. The heart can be given renewed activity, the kidneys can be supported and brought into healthier action and ampler functionation; and protectives with regard to the anæsthetic state for the performance of the operation are both numerous and efficient: so that it is only the most extreme cases in which operation must be denied on account of these conditions alone. Diabetes is a condition that is definitely forbidding to operative prospects, although cases are recorded of successful prostatectomies in the face of this condition. Still it must be acknowledged that when this condition prevails, palliative measures that are at all successful should be relied on as far as possible, at least until the diabetes is brought well under control.

In discussing the contra indications to operative interference in prostatic obstructions, it must be remembered that there are numerous cases of stenosis at the neck, received and detected early enough in their developmental period to permit of success in their treatment with dilating measures. This has been clearly proved in numerous instances in the writer's experience, and

each case so proved is a living denial of the necessity of operation—in this particular case, at least.

Therefore, while we are ready to subscribe to the testimony of efficacy of operative methods of relief for obstruction at the neck, we must remember that many cases may be permanently relieved without operation, and that they have a right to a trial of the more conservative methods first; while in other cases operative methods are unjustified because of the physical and other conditions prevailing. Diagnosis and discriminating judgment should govern the situation.

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VESICAL OBSTRUCTION BY DISEASED SEMINAL VESICLES

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SINCE the seminal vesicles, enclosed in unyielding fascial envelopes, are closely bound to the base of the bladder, infections of the former may, and often do, induce lesions of the bladder-opening mechanism which result in partial or complete retention of urine. These lesions are —

1. *Acute infections of the vesicles, causing inflammatory swelling of the bladder neck;* the consequent inability to open the vesical orifice (like the inability to open oedematous eyelids) results in partial or even complete retention of urine. This sequence is familiar as a feature of acute gonorrhoea; the swelling of the bladder neck may result in complete retention of urine and compel the use of the catheter until the distended vesicle discharges its contents into the urethra, whereupon the oedema of the bladder neck rapidly subsides and the urinary retention ceases. This sequence of events is commonly ascribed to the formation and bursting of a prostatic abscess, that it is often due to a vesicular abscess has been repeatedly demonstrated in my clinic at Rush College, where the straining, distended bladder has been promptly relieved by washing out the infected vesicles through vasostomy, without any treatment directed to the prostate or bladder.

2. *Chronic infections of the vesicles, with chronic partial retention of urine.* Some twenty years ago, bilateral vasectomy was extensively practiced for the relief of bladder troubles which, because the subjects were elderly men, were ascribed, through lack of discrimination, to prostatic enlargement. Marked improvement amounting sometimes to permanent symptomatic cure with virtual disappearance of residual urine, was observed by many operators in a minority of cases so treated, some noted surgeons (Rovsing for example) reported equal success in a decided majority of their cases.

Yet we now know that occlusion of both vasa, whether through bilateral epididymitis

or through surgical interference, has no appreciable effect upon the structure of the prostate, normal or other. Indeed, the only possible explanation of the abolition of residual urine in elderly men through vasectomy — which, like many others, I have personally witnessed — is the proved abolition of infection and distention in the seminal vesicles. To this innocuous desuetude of the vesicles, rather than to any effect upon the prostate, must be ascribed the improvement of the bladder function often achieved through bilateral vasectomy. That this operation must fail to relieve retention due to actual prostatic hypertrophy, is equally obvious.

3. *Fibroid induration of the bladder base and neck, resulting from perivesicular infections.* Our experience in the removal of obstructions to urination in elderly men comprises four stages. First, we recognized only the obvious mechanical obstacles, the prostatic adenomata, second, we learned that fibroid degeneration of the vesical orifice,



Primary carcinoma of seminal vesicle. Röntgenogram (retouched) of both vesicles filled with collagenol solution a year before death, showing obliteration of upper part of cavity of diseased vesicle.

which exists with, as well as without, actual hypertrophy, is a frequent factor in chronic urinary retention; third, we learned through the practice of vasectomy that the obstacle to urination may lie in infections of the seminal vesicles; and, fourth, we are learning that through retrovesical infections the bladder may become permanently incapable of complete evacuation, even though no mechanical obstruction exists. Thus a man forty-two years old developed a severe infection of vesicles and perivesicular tissues, with complete retention of urine. Irrigation of both vesicles gave but slight relief. Six days after the initial chill, incision into the

rectovesical tissue evacuated much pus (streptococcus and colon bacillus). Five years later the bladder retains four ounces residual urine, though no obstruction exists; and the rectovesical tissue feels like a scar.

4 *Primary carcinoma of the seminal vesicle* (diagnosis confirmed at autopsy) has caused in one case partial, in another complete, retention of urine. In the latter, operated at St. Luke's Hospital, no obstruction whatever could be discovered in the bladder or urinary exit; yet retention was complete until relieved by a suprapubic drain, inserted more than a year before death, which was due to metastases in the liver.

FREQUENCY OF RECURRENCE OF STONE IN THE KIDNEY
AFTER OPERATION¹

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FROM the point of view of the patient, the most interesting question after operation for stone in the kidney or ureter is whether or not the stone is likely to recur. A fairly careful search of the literature appears to show that this subject has not been highly thought of as a subject for study. We seem to have been chiefly interested, not in the probability of recurrence, but in the consideration of operative mortality, each vying with the other in a very proper desire to get a low mortality. Much space has been covered by discussions of technique, all proper in themselves, but leading to nothing if the prime end and object of the operation, cure of the patient, is not to be attained. I can find no useful statistics bearing upon this important question of recurrence after operation.

This is perhaps more easily explained if we remember that it is only within comparatively recent times that a diagnosis of recurrent stone could be made with accuracy. Our recent study has clearly shown that nothing short of a careful radiograph (and not that even in all cases) will make sure of the diagnosis. Very little reliance should be placed upon the statements of patients in regard to their health and it is not even safe to assume that the opinion of the family physician is accurate. Quite a number of patients who have reported to us that they were cured, and a smaller number who have been reported by their physician as cured, have been shown by subsequent examination including X-ray to have recurrent stone, and the history was such as to lead us to believe that this stone has existed at the time of their previous examination. Not only in this question, but in most questions of late results, the statements of the patient should be taken with great caution, and we have been altogether

too much in the habit of relying upon this form of evidence in reporting our results, to the ultimate detriment of the profession of surgery because we thus obtained credit for that which we could not in fact perform.

This paper is based upon a study, which we have been carrying on during the past year, of patients operated upon for stone in the kidney or ureter during the eight years previous to January 1, 1914. This date was selected because it excluded cases recently operated upon and because there was a fair probability that stone recurrence would have taken place in many if not most of the cases within this time were it going to occur. The cases are taken from the records of the Massachusetts General Hospital and were operated upon by the surgeons on duty. They therefore give a sound view of the results obtained by the general surgeon during that period and are not open to the criticisms that they are the results obtained by highly special and skilled operators. They may, we think, be taken to represent a fair average of the results obtained throughout the country. The list included 155 cases, but it was impossible to obtain actual presence in the clinic of more than 87, and our conclusions are therefore based upon the study of those cases. We have insisted that all the patients should come to us so that a careful physical examination, an examination of the urine, and an X-ray could be made. On nothing less than this are we willing to rely in reporting end-results.

We have recorded as cured those patients who presented a negative physical examination so far as the urinary tract was concerned, who had a urine normal on chemical and microscopic examination, and in whom the X-ray was negative. We recognize that there is a possible source of inaccuracy here, in that

¹ Read before the American Association of Genito-Urinary Surgeons, White Sulphur Springs, West Virginia, May 18-20, 1915.

the urine may be normal and the X-ray may be negative in the presence of stone in the kidney or ureter. But this combination, especially in patients whose calculi have previously been detected by the X ray, is so unusual that we have been willing to disregard it

Of the 87 cases thus carefully examined there were 66 cases of stone in the kidney and 21 cases of stone in the ureter. Roughly tabulated, the cases of stone in the kidney show that 34, or 51 per cent, were well, and 32, or 49 per cent, were not well. Of the cases of stone in the ureter 15, or 71 per cent, were well, and 6, or 29 per cent, were not well

With this rather surprising showing of only slightly more than half the cases cured, it was interesting to see whether or not the type of operation was an important factor in the result. We have therefore divided them into the cases which were treated by nephrotomy, pyelotomy, or nephrectomy. Thirty cases of nephrotomy showed 13, or 43 per cent, well, and 17, or 56 per cent, not well. Of 33 cases of pyelotomy, 16, or 49 per cent, were well, and 17, or 51 per cent, were not well. Of 12 cases of nephrectomy, 11, or 92 per cent, were well, and 1, or 9 per cent, was not well

It should perhaps be explained that in referring to the cases of nephrectomy as well or not well, we refer to the patient rather than to the kidney. We do not at this time intend to discuss whether or not a kidney in alcohol is to be regarded as cured or not. These cases of nephrectomy, however, are of some interest as bearing upon the question of whether stone in one kidney has any influence upon stone formation in the other. This series, of course, is too small to justify any accurate conclusion, but the fact that in only one case did stone occur in the remaining kidney after nephrectomy shows that there is some condition in the kidney itself which influences the formation of stone and which does not exist to the same extent in the opposite kidney.

There has been much discussion over the influence of infection upon the recurrence of stone. It is to be regretted that these cases do not enable us to discuss the point to advantage, as in most of them no cultures of

the urine were taken before operation. It may, however, be pointed out that infection of the kidney is unlikely to produce any greater liability to recurrence of stone than to the primary formation of stone. The relation of infection to stone formation, if any there be, is still in the realms of discussion, but it is our present opinion that it is not a factor of overwhelming importance, for were such the case stone in the kidney would be far more common in the female than it is in the male, following the well-known fact that kidney infection is more common in women than in men

In this small series of 155 cases there were 107 men and 48 women. Larger statistics appear to show that the probability of the occurrence of stone is about equal in men and women. We may, therefore, discount infection as a factor of great importance in the formation of stone.

In looking for further evidence on the question of the liability to recurrence and its causes, we tried to discover whether the length of time during which the stone had been in the kidney had any bearing upon this question. It does not, however, appear to have been an important factor. Thus of 8 cases with a history of less than one year, 4 cases recurred and 4 did not. Of 4 cases of about two years' duration, 2 recurred and 2 did not. Of 14 cases of six years' duration, 4 recurred and 10 did not; of 5 cases of about ten years' duration, 3 recurred and 2 did not; of 6 cases of fifteen years' duration, 4 recurred and 2 did not, while finally, of 6 cases of 20 years' duration, 3 recurred and 3 did not

It would thus appear that the probability of recurrence in the cases of one year's duration is precisely the same as those of 20 years'. We seem to get nowhere by this line of inquiry

Some interest does apparently attach to the age of the patient at the time operation is undertaken. Thus in patients of less than 35 the probability of recurrence is comparatively large, while in patients over 40 the probability of recurrence is comparatively small. This but follows out the well known fact that the majority of stones in the kidney form during the period between 15 and 35,

and that after that age stone formation in the kidney becomes markedly less probable.

In attempting to sum up our results, it appears that we shall have to revise somewhat our rather optimistic views as to the results of operation for stone in the kidney. It has been clearly shown that the risk of these operations is not great. In our series of 155 cases there were 5 deaths, 2 following nephrectomy, and 1 each following nephrotomy, pyelotomy, and ureterotomy. Most of us have, I think, been in the habit of assuring the patient that the probability of cure is large. On the basis of these cases we can only say to the patient that the risk of operation is

small; that the danger of progressive destruction of the kidney by the stone, if it is left, is large; that the probability of recurrence is considerable; that it depends somewhat upon the age, undoubtedly somewhat upon the method of operation and the skill with which it is carried out, but clearly somewhat upon the entirely unknown factor—the liability or the ability of that particular kidney to form concretions.

The outlook for the cases of stone in the ureter is apparently considerably better. In this small series of 21 cases, the probability of permanent cure seems to be about two to one.

SOME DETAILS IN THE SURGICAL TREATMENT OF TUMOR OF THE BLADDER¹

By GEORGE W. WARREN, M.D., F.A.C.S., New York

ALTHOUGH in recently compiled statistics it is shown that the best results from treatment of bladder tumors are obtained by fulguration, I think surgical procedure eventually will be the method of choice. The history of the treatment of neoplasms in all departments of medicine has been first palliative and then radical surgical intervention with an aim to a cure. In cases of bladder tumor the inability to make a diagnosis of malignancy without microscopic examination is, to my mind, the reason for the popularity of the fulguration method. When the number of cases of simple keratosis and peculiar irregularities of the mucous membrane that have been treated by fulguration and reported as cured is considered I believe statistics favorable to fulguration will not be shown.

To my mind a cancer is a cancer no matter where situated and treatment which has been a failure in one part of the body will not cure in another. As no one expects a cure by fulguration in cases of out-poken malignancy of the bladder why expend so much energy upon a method granted to be efficient only in a small number of cases? If but one half the energy and ingenuity displayed in devising electrodes and currents had been expended in perfecting operative procedures statistics today would be far better.

In this brief paper I wish hastily to run over the points which either by failure or success, have led me to believe them to be of surgical value.

There must be excision of the whole thickness of the bladder wall at the region of the tumor. To do this the bladder must be separated from the neighboring tissues at this point. In my experience, this is best accomplished extraperitoneally. If the skin incision is large enough and the patient put in the extreme Trendelenburg position I have found no necessity for opening the peritoneal cavity. An unopened peritoneal

cavity reduces the mortality from peritonitis. The bladder should be freed from the peritoneum and adjacent tissues only at the point of resection. When the tumor is situated near the trigonum, only one side of the bladder need be freed. When, however, the growth is located upon the back or upper portion of the bladder, the peritoneal cavity may have to be entered, as the peritoneum sometimes is adherent to the bladder overlying the tumor. The attachment of the urachus to the bladder has, as a rule, to be cut to permit free exposure of the bladder with a tumor thus situated. This cutting of the urachus opens the peritoneal cavity.

In all my cases there has been infection from the drainage tube which has involved more or less of the denuded area. This led me to free as little of the bladder as possible consistent with complete removal of the tumor. Normal perivesical fat allows far more mobility of the bladder than fat scarred by infection. Therefore the smaller the area involved in the separation of the bladder the better the mobility. The bladder should be well distended with fluid or air by means of a urethral catheter and not allowed to collapse during the separation, for rubbing of the bladder walls together may dislodge a portion of the growth. After the bladder is freed it is allowed to empty itself as far as it will by the urethral catheter, which is allowed to remain in place during the separation. Open the bladder by a small cystotomy wound between guide sutures and remove the remainder of the fluid by aspiration, care being taken not to allow it to soil the freshly cut tissues.

I have found that in cases in which the growth has been handled or even touched there is grave danger of recurrence, which generally takes place at the site of the bladder wounds often in the primary cystotomy incision. In one of my cases the growth was so heavy it broke from the bladder wall during

¹Read before the American Association of Genito-Urinary Surgeons, White Sulphur Springs, West Virginia, May 18-20, 1915.

INSUFFICIENCY AT THE URETEROVESICAL JUNCTION¹

BY HERMAN L. KRETSCHNER, M.D., F.A.C.S., AND JAMES R. GREEK, M.D., PH.D., CHICAGO

CASES of dilatation of the upper urinary tract due to obstructive lesions are not uncommon, and when dilatation is found associated with one or another of these various lesions producing obstruction, there is no difficulty in explaining cause and effect. The lesions of the ureter met with under such circumstances may be found within its lumen, such as stones, stricture, tumor, kinks, etc., or the lesions may be found outside of the ureter, such as abdominal tumors, various uterine and ovarian tumors, pregnancy (?), and so on. Not infrequently the lesion exists farther down in the urinary tract, as for example in the prostate, vesicles, or urethra.

Marked dilatation of the urinary tract occurring *without* the presence of obstructive lesions and in the absence of lesions of the central nervous system are very rare, and up to the present time their pathogenesis is unknown.

The case we wish to present is considered worthy of report for the following reasons:

1. The rare occurrence of this condition.
2. The scarcity of case reports in the literature.
3. The obscure and indefinite factors mentioned in the case reports, as bearing on the etiology.

G. D. S., male, age 20, first seen November 28, 1913. In December, 1911, he passed a life insurance examination. The patient stated that in October, 1912, he was in a push ball contest, three days after an attack of la grippe. Several days following the game, he felt tired and seemed unable to get rested. The physician whom he consulted at this time told him he had fever (102°) and that there was pus in the urine. This illness lasted about a week, during which time pus was continually present in the urine. The following spring he felt well enough to play baseball with the university team. At the time of admission there were no urinary symptoms, the patient seeking relief for the pyuria.

Physical examination. The patient is a well developed and well nourished young man, of light frame. Head and neck, eyes react to light and accommodation, movements normal, facial movements normal. Mouth tongue protrudes in

midline, no tremor, pea-sized polyp to left of raphe near tip, teeth in fair condition, throat slightly reddened, a few shot- to pea sized glands on either side of neck. Chest lungs negative, heart negative, no murmurs or thrills, pulse regular. Abdomen: liver, spleen, left kidney, right kidney (?), not palpable, inguinal glands pea sized. Genitals negative. Extremities: Arm: epitrochlear glands on both sides are palpable. Leg no scars, edema, Babinski, or clonus, knee jerk present. Rectal examination negative. Blood examination: erythrocytes, 5,380,000, leucocytes, 11,200, haemoglobin (Dare), 78 per cent, central nervous system negative. Because of the subsequent developments in this case, special examination of his central nervous system was made for us by Dr. James B. Herrick, who reported negative findings, so far as any demonstrable lesions of the central nervous system are concerned.

Cystoscopic examination, January 3, 1914. There was a generalized trabeculization of the bladder. Internal urethral orifice negative. Both ureteral orifices were enormously dilated. Mild cystitis present.

Ureteral catheterization. The catheters passed all the way up into the pelvis of each kidney without obstruction. On one side two No. 6 catheters were inserted, and there appeared to remain room enough for two more. Pus was found in the urine from both kidneys. Pure culture of staphylococcus albus on both sides. Examinations for tubercle bacillus were negative.

Phenolsulphonephthalein test. First test time of appearance, 21 minutes, total output, 61 per cent. Second test intravenous injection: time of appearance, left side, 7 minutes, right side, 8 minutes, output, left side, 20 per cent, right side, 13 per cent (for thirty minutes' collection).

Urinalysis. March 15, 1914. Clear, amber, 1,012, nucleo albumin positive, serum albumin positive, sugar none. Microscopical examination shows the presence of hyaline and granular casts, erythrocytes, and leucocytes.

X ray examination for stone was negative. Wassermann test negative.

Because of the cystoscopic appearance of the ureteral orifices, a provisional diagnosis of bilateral dilatation of the upper urinary tract was made. It was then decided to verify this diagnosis by obtaining a pyelogram of both kidneys, which was carried out in the following manner. The patient was asked to void. Eight ounces of a 20 per cent solution of cagentos were injected into his bladder through a soft rubber catheter. The patient was placed in a prone position on the X ray table. He was then asked to urinate, at the same time com-

¹ Read at the annual meeting of the American Urological Association, Baltimore, April 13-15, 1915.

pressing the urethra. After the patient's continued attempts to void with his urethra compressed, an X ray picture was taken (Fig 1). This shows that the carentos solution has found its way into both kidneys, that the ureter is inserted at the lowest part of the enormously dilated kidney pelvis, and that both ureters are very much dilated. The right ureter and pelvis seem to be much more dilated than the left. A large amount of carentos can be seen in the patient's bladder. Of interest is the ureteropelvic junction. The insertion of the ureter into the most dependent part of the pelvis excludes any local obstructive condition.

In a review of the literature at our command, we have found reports of sixteen similar cases.

CASE 1. J B Clark. Widow, age 50. Duration of illness, four weeks. Nocturnal frequency of urination. Some incontinence and cloudiness of urine. Cystoscopy. The right ureter was markedly dilated, the left ureter was dilated, but less so than the right. Diagnosis made by filling the bladder with collargol and allowing the same to find its way into the kidneys, as proved by the radiograph.

CASE 2. Bacharach. Female, age 27. History of urinary disturbance since early childhood. At the age of 15 had to strain for half an hour before she could get the urine started. Cystoscopy. Left ureter was siltlike in appearance, right ureter dilated. Diagnosis made by filling the bladder with collargol which found its way into the right kidney, and proved by radiograph. Treatment, nephrectomy.

CASE 3. Bacharach. Female, age 16. Up to the age of 14 the patient had had enuresis, since then has had difficult urination. Following a cold, she had burning on urination and turbid urine. At the time of her admission she was voiding once every ten minutes. For the past eight days she has not been able to void at all. Cystoscopy. Trabeculation of the bladder, marked cystitis, both ureteral orifices were enormously dilated. Collargol was placed in the bladder, and found its way into the kidneys on both sides, as proved by radiograph.

CASE 4. Israel. Female, age 32. After her first confinement she had frequency, hæmaturia, and bladder cramps. Patient had repeated attacks of bladder disturbances and finally developed pains in both kidneys. Cystoscopy showed dilatation of both ureteral orifices, right-sided nephrectomy.

CASE 5. Israel. Female, age 20. Left sided renal colic, hæmaturia, pain in the bladder, and a more or less constant desire to urinate. Cystoscopy showed no dilatation of the ureteral orifices. Nephrectomy. (This case and the cases of Legueu and Papin are the only ones of the recorded cases in which the so called "atonic dilatation" of the ureter was present without cystoscopic changes in the ureteral orifices and the bladder.)

CASE 6. Fedorow. Male. At the age of 14 he had had complete retention of urine. Removal of a stone by ureterotomy. At the age of 25, had

attacks of right sided pain, associated with hæmaturia. Cystoscopy revealed a dilated ureteral orifice. Partial resection of kidney and ureter. Sections of dilated ureter showed an absence muscle fibre.

CASE 7. Fedorow. Female, age 19. Three weeks after her last pregnancy the patient had attacks of chills, fever, and abdominal pain. Two weeks before admission, pain and swelling in the region of the right kidney. Nephrectomy.

CASE 8. A. Weiser. Post-mortem report. Male, age 20. The post-mortem report was as follows: Bilateral polycystic kidneys, enormous dilatation of both kidney pelves, ureters, and the bladder, without any obstruction. Both ureteral orifices easily admitted two fingers.

CASES 9 and 10. Voelcker. Two cases, both in women. These patients came seeking treatment for an existing cystopyelitis. Cystoscopically, the ureteral orifices were dilated. The bladder was filled with collargol, and the patients were asked to void, at the same time, pressure was exerted at the external ureteral orifice with the finger. The radiograph showed the entire urinary tract filled with collargol solution, due to insufficiency of the ureteral vesical valve.

CASES 11, 12, and 13. Legueu and Papin. These three cases were cystoscoped and enlargement of the ureteral orifices found. In one case one of the ureters was as large as a fifty-centime piece, and in the other two they were still larger. Collargol was injected into the bladder and a radiograph taken, and in the three cases the entire urinary system was filled with the collargol. In another case, in which the ureteral orifice was not dilated, collargol however appeared in the ureter.

CASES 14 and 15. Halle, in discussing the paper of Legueu and Papin, reported two cases which occurred in children aged 5 and 6 respectively.

CASE 16. Buerger. Male, age 8. Residual of four or five ounces, although micturition appeared normal. Cystoscopy revealed dilatation of both ureteral orifices. Dilatation of upper urinary tract proved by radiograph, after having first placed argyrol solution into the bladder, which found its way into the kidneys.

PATHOGENESIS

Four theories have been advanced to explain the occurrence of this condition.

1. Israel, in his report of similar cases, has used the term "atonic dilatation of the ureter." In his first case the dilatation involved primarily the ureters, the pelves being involved to a less extent. His explanation of the occurrence of this condition, without the presence of an organic obstruction to the urinary flow, is as follows: "He believes that dynamic causes can produce the same *Stau-*

ungerscheinungen as can organic causes. The dynamic *Abflusshinderniss* in this case consisted of the irritability of the bladder, resulting in frequent attempts to void, associated with a spasm of the sphincter. In spite of the intense pressing, only a few drops were voided, and at times nothing at all. As a result of these conditions there occurred a marked increase in the intravesical pressure, which occurred at frequent intervals and prevented a regular emptying of the ureter into the bladder. Israel believes that the cause of the entire process was due to an injury of the bladder, following a forceps delivery." In Israel's second case, atonic dilatation and elongation of the ureter were found at the time of operation, and he was unable to determine the cause therefor.

2. Fedorow explains the hydronephrosis in his first case as being due to atony of the ureter, which latter condition was called forth by *Stauungerscheinungen* in the kidney pelvis and ureter. All of these conditions were first manifest when the stone lodged in the ureter. That these conditions of stasis recurred is proved by the recurrent attacks of hematuria. As a result of this stasis there was a gradual disappearance of the muscular elements of the ureter and pelvis, which were replaced by scar tissue. Following this, the ureter and renal pelvis lost their elasticity and power through peristalsis to propel the collecting urine into the bladder. Lastly, complete atony of the ureter set in and the fluid could not be emptied from the hydronephrotic sac. In the second case, Fedorow explains the hydronephrosis as being due to the atony of the ureter and states that the atony is due to the stasis of the urine in the kidney.

3. Bacharach believes that in his two cases the primary cause of the atony of the ureter must have been a congenital insufficiency of the ureteral sphincter, rather than an ascending infection, which he thinks was secondary. Another factor by means of which his cases were differentiated from the others in the literature was that in both cases complete or incomplete retention was present, an occurrence which was not noted in the recorded cases. Thus, he believes, is a

further argument in favor of the insufficiency of the muscular elements of the urinary tract. Halle believes this condition to be of congenital origin. Legueu and Papin believe that in their cases the cause of this condition must have been congenital, because their cases were young individuals and without any antecedent urinary trouble. In one case a stone was found which after removal proved to be of secondary formation. In one case an operation had been performed on the genitalia which preceded the urinary difficulty and which did not explain the condition.

In our case there was no history of previous urinary disturbance and no evidence to show that he had had any inflammatory condition in his urinary tract. Just prior to the onset of his trouble, he passed an examination for a life insurance. There was no history of trauma such as was present in Israel's case. There were no urinary symptoms at the time of admission to the hospital.

4. Karoffa-Korbut, as a result of his animal experiments, believes that in some cases atony of the ureter is a result of an inflammatory process (ureteritis ascendens) and that it can lead to pyelectasia and hydronephrosis. This fact is questioned by Bacharach, who was unable to find any evidence of inflammatory changes in the ureter which he obtained by surgical operation.

Hagner of Washington a short time ago, reported four cases of regurgitation of fluid from the bladder into the kidneys with ureteral catheters *in situ*, so that the collargol solution which had been placed into the bladder syphoned out of the ureteral catheters. Hagner believes that this phenomenon occurs only in chronic inflammatory diseases of the ureteral offices and is produced by infiltration and cicatricial formation in this region, which causes a destruction of the valvelike arrangement in the normal ureteral offices. With his views we are in perfect harmony. Regurgitation of fluid through diseased ureters has been recorded, and has also been seen after cases of nephrectomy for tuberculosis. It is obvious, therefore, that the cases described by Hagner do not belong to the group of cases under discussion.

DIAGNOSIS

In the cases reported prior to the advent of the pyelograph, the diagnosis was made at the time of operation (Israel, Fedorow). In all of the recently reported cases, the diagnosis was made by cystopyelography, that is, by filling the bladder with a solution of one of the newer silver salts and allowing it to find its way past the ureterovesical valve and on up into the kidney. Voelcker, as did we, forced the fluid into the kidneys by having the patients urinate against pressure. In most of the cases the condition was found present on both sides (Clark, Bacharach, Israel, Fedorow, Voelcker, Legueu and Papin, and Buerger in our case).

The method of filling the upper urinary tract by placing a medium opaque to the roentgen ray, such as cagentos, in the bladder and allowing it to flow into the kidneys was first used by Lichtenberg in 1909. This is the simplest and most accurate method for diagnosing this rare condition which we have at our command.

It has also been noted, clinically, that the cagentos solution can find its way into the ureter in cases in which the ureteral orifices appear normal when viewed with the cystoscope.

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Figure 1 Shows the bladder distended with cagentos solution, which has found its way into both ureters and both kidneys. The ureters are enormously dilated particularly on the right side.

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NOTE ON THE ANATOMY OF IMPERFECTLY DESCENDED TESTES¹

BY ALFRED C. WOOD, M.D., F.A.C.S., PHILADELPHIA

THE testicles, originally in relation with the kidneys, opposite the first and second lumbar vertebrae, begin their descent during the second month of fetal life. By the end of the third month they will have approached the anterior abdominal wall, where they remain until about the end of the sixth month. After evagination of the abdominal wall at the site of the internal ring, which is followed by the vaginal process of peritoneum, occurs, the sexual glands begin the final stage of their transit about the seventh month, and usually reach the scrotum shortly before birth (Piersol).

That this sequence of events is not invariably fully accomplished is well known. The descent may be delayed or may be arrested at any point of the normal course. Wrisburg examined 103 male infants at birth, and found both testicles in the scrotum in but 73 (70 per cent). Sach observed perfect descent in only 86 per cent of 143 male infants from one to four months of age. In the great majority of cases in which a testis is not apparent at birth it may be expected to descend later, in most instances in the first few days or weeks of post-natal life. As an indication of the tendency of these organs to reach their normal position, Coley's observations are very significant. At the Hospital for Ruptured and Crippled, of 18,410 male children under 14 years of age applying on account of inguinal hernia, there were 561 instances of detained testes (3 per cent), of 3,848 boys between 14 and 21 years of age there were 92 cases (2.2 per cent), of 37,370 men over 21 years of age there were 75 examples (0.2 per cent). From these figures it appears that above the age of 21 years the proportion of imperfectly descended testes observed is less than one tenth of the ratio between the ages of 14 and 21 and about one-fifteenth of that under 14 years. The numbers are sufficiently large to warrant their acceptance as a fair average, they show

clearly that there is a very good chance of these detained organs reaching their normal situation up to the time of puberty, if not even later. These facts should be kept in mind when considering the reports of successful orchidopexies in early years.

From the foregoing it seems to me a distinction might be made between delayed descent, which could be called "detained," and permanent arrest or retained testis, the latter term being employed in the case of adults in whom further progress is not to be expected.

In view of what has been said, it would appear that, in the absence of complications requiring relief, operation might very properly be postponed at least until after the fourteenth or fifteenth year. The only argument for earlier interference is the impression, which seems more or less widely prevalent, that the organ will not develop properly if the descent has been incomplete, while growth as well as function will be stimulated if it is transferred to the scrotum. This view I believe to be based on insufficient premises. The tendency of these imperfectly descended organs to complete their evolution has been mentioned. When we read of a testis enlarging after orchidopexy it may well be questioned whether an equal degree of development might not have occurred without operation.

The retained testicle is associated with certain definite anatomical peculiarities to which I will very briefly refer.

1. As regards size and consistence, most authors state that the gland is abnormally small and that it is less firm than it should be. A few instances are reported however in which the retained organ was said to be normal in all respects. While I am not prepared to controvert this statement, I believe that if all of the cases were minutely examined such instances would be very rare. John Hunter held the opinion that the retained organ was never normal. Many others have

¹ Read before the American Association of Genito-Urinary Surgeons, White Sulphur Springs, West Virginia, May 18-20, 1915.



Fig 1 Undescended (left) testis associated with left inguinal hernia. Epididymis absent vas undeveloped. Upper margin of drawing represents line of section of cord



Fig 2 Undescended (left) testis, strangulation from axial rotation

since expressed the same view. In this connection, important evidence has been furnished by the microscopic studies of several observers. This feature was especially emphasized in a valuable paper by Odiorne and Simmons¹. While the appearances vary greatly in different cases, they state that careful examination will always show a marked deviation from the properly descended adult organ. The variations do not appear to have any constant relation with the exact degree of failure in transit or with the age of the patient. The important changes consist in an increase of fibrous tissue, the albuginea is thickened, sometimes very greatly so, the basement membrane of the tubules is thin, the peritubular connective tissue is increased, and the cells are of embryonic type. The "interstitial cells" are said to constitute a striking feature of these organs. Normally these cells are seen during childhood, but disappear about puberty. In undescended testes the reverse is said to be true.

The following report of the microscopic

appearances in one of the cases of this series is fairly typical.

"Section 'A,' through the vas deferens about one inch from the globus minor, shows a distinct lumen which is entirely empty of spermatic elements. The epithelium is more or less broken irregular, and has at places evidently been proliferating into the duct in a papilliform manner. The mucosa and submucosa are very scant.

"Section 'B' shows a portion of the epididymis (globus major) and a part of the body of Highmore with a vasa efferentia. Here is seen a network of tubes of about the ordinary size, but in which the epithelial lining is decidedly altered. The cells are apparently too low, their cilia have probably not existed and the cells are shrunken and wart-like. No distinct spermatozoa can be made out but there is a finely fibrillated material in which little dots of chromatic substance are to be seen, which doubtless represent deteriorated spermatic elements. The epithelium in the body of Highmore is more typical, and apparently shows ciliation. The cells, however, are badly degenerated. Here again the same appearance of deteriorated spermatozoa is occasionally met with but no clearly defined, well preserved spermatic elements are visible.

"Section 'C' globus minor with a small portion of testis proper. The tubes have the same appearance as in 'B'. They are atrophic. The reticular substance shows excess of intertubular tissue which is also atrophic. There is no spermatogenesis."

¹Ann Surg Phila., 1904 xl

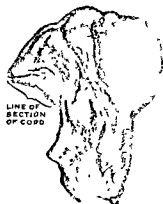


Fig. 3a Undescended testis showing line of section

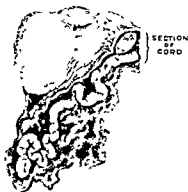


Fig. 3b Undescended testis showing section of cord

2 In addition to the underdevelopment, the undescended testis, although retaining the general form of the normal organ, does not acquire the usual relations to contiguous structures. The epididymis is not closely attached to the body of the gland but is separated by a definite space. The common mesentery of the testis and epididymis, which is usually short and fixes these parts closely to the peritoneum, becomes elongated, forming a pedicle (Figs 2 and 4). This elongated mesentery, with the unusual appearance mentioned, has suggested to some a resemblance to the ovary with the adjacent mesosalpinx (Bland-Sutton). It also appears to be a predisposing cause in the rotation and strangulation sometimes observed in cases of non-descent. This is, I believe, a better explanation than the suggestion of Owen quoted by Bland Sutton: "It is almost as if Nature herself, disappointed with her imperfect work, were anxious to cast it down a Tarpaeian rock."

3 The vaginal process is unusually capacious, due to its reflection on the elongated mesentery. It not infrequently occupies its normal position in the scrotal pouch even though the testis has been arrested in its descent. This condition has been well illustrated by Coley and others. It was a very prominent feature in my cases, of which the following is an example:

A man of 47 years presented himself with an incomplete right inguinal hernia, the corresponding testis being just within the external ring, never having been in the scrotum. At operation there was found a capacious vaginal and funicular sac which contained a little free fluid. The serous sac and the free end of the vas were well in the scrotal pouch and at least two inches below the lower border of the testis. At the internal ring the funicular process was tightly adherent to the cord, the communication with the abdominal cavity being entirely closed. Behind the testis, which lay in the canal, the bulging of the peritoneum and viscera was evident.

The funicular process is rarely obliterated in these cases, although occasionally, as in the one just mentioned, it may become closed off at the internal ring. This may be explained in part, at least, upon embryologic considerations. The vaginal process of peritoneum precedes the testis in its descent. The serous membrane covering the testis and adjacent parts like that covering the abdominal viscera, never becomes adherent to the opposing serous surface except as the result of disease. When, therefore, the peritesticular peritoneum remains in the canal, a non-adhering surface is in contact with the funicular process and adhesion does not occur.

4 Inguinal hernia is very commonly associated with imperfect descent of the testis. Opinions differ in regard to the exact frequency of this complication, but it is stated

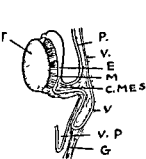


Fig 4

Fig 4 Showing elongated common mesentery of testis
t, Testis, *p*, peritoneum, *v*, vas, *e*, epididymis, *m*, mesorchium, *c*, common mesentery, *v p*, vaginal process, *g*, gubernaculum (Keith)

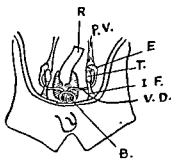


Fig 5

Fig 5 Fœtus of two and one half months *r*, Rectum, *p v*, plica vascularis, *e*, epididymis, *t*, testis, *i f*, inguinal fold, *v d*, vas deferens (Keith)

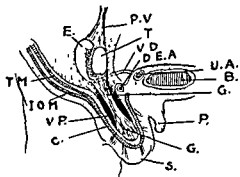


Fig 6

Fig 6 Fœtus of sixth month *p v*, Plica vascularis, *e*, epididymis, *t*, testis, *v d*, vas deferens, *d e a*, deep epigastric artery, *u a*, umbilical artery, *b*, bladder, *p*, penis, *g*, gubernaculum, *s*, scrotum, *i m*, transversalis muscle, *s o m*, internal oblique muscle, *v p*, vaginal process, *c*, cremaster (Keith)

to be from 60 to 70 per cent of all cases. A distinction must be made, however, between the actual presence of a hernia and the existence of a potential hernial sac. In a report of 126 operations for undescended testis, Coley states that he was able to demonstrate a hernial sac in every instance.

5 In addition to these more or less constant and obvious abnormalities, I wish especially to call attention to defects in the development of the epididymis or of the testicular end of the vas deferens. Very scant reference to this condition appears in recent literature, but earlier writers, among whom may be mentioned Pollin, Cloquet, Godard, and Curling, reported such cases. A few years ago, in casually examining a testicle that had been removed during an operation for the cure of a troublesome hernia, it was apparent that the vas was not connected with the gland in the usual manner. The specimen was therefore carefully dissected, and the vas was found to terminate in a series of coils with a blind extremity which was not attached to the testis in any way. These coils appear to represent the globus minor of the epididymis. The case was reported before this society at its meeting in 1910 (see Fig 1). Unfortunately, an opportunity for an autopsy presented later, and an unusual group of anomalies was discovered. The findings then reported may be briefly recalled: The left

kidney was represented by a small tab of fibrous tissue and connected with the ureter by a minute fibrous band which seemed to have no lumen. The left ureter was represented by a thin fibrous cord. Careful examination of the bladder did not reveal any ureteral orifice on the left side. That on the right side was normal. The left seminal vesicle was enlarged and cystic, one portion projecting into the bladder on the left side. The remaining portion of the vas deferens was a short, coiled, blind tube six centimeters in length; the vas in this case, therefore, being deficient at both ends. All of the structures involved are derived from the wolffian body and duct. The particular combination of anomalies is readily explained by arrest in development of this fetal structure.

Since reporting this case I have had an opportunity of dissecting five specimens of undescended testes. In four of these the condition of the epididymis was found to be practically the same as in the one just referred to (Fig 3). While these cases are too few in number to form the basis of a definite statement, it is reasonable to conclude that this defect occurs more frequently than is generally recognized.

It is this last anomaly, observed in five of six cases examined, that led to these notes. An explanation of this condition is to be found in the embryology of these structures. The

testis and vas develop independently: the former with the vasa efferentia and conivasculosi (globus major) originates in the genital ridge on the mesial side of the wolffian body, and the latter with the globus minor is derived from the wolffian duct, which is situated on the outer border of the wolffian body. The duct is originally closed at both ends, but as growth continues the testis and vas are joined by the development of intermediate tubes. When the cloaca divides into bladder and rectum, the lower end of the wolffian duct becomes connected with the prostatic urethra through the ejaculatory duct.

As the origins of the testis and vas are wholly distinct, arrest of the development of one does not affect the other, but both are frequently found abnormal in the same case, illustrating a more wide-spread cause than when one of these structures is deficient.

In Fig 5, showing a two and a-half-months' foetus, it will be seen that the testis and epididymis are quite distinct. At six months these two structures are coming into closer union (Fig 6). In some of the specimens I have examined the development appears to have been arrested about this stage.

In those cases of imperfect descent in which the vas and epididymis (globus minor) are found in the scrotum it has been suggested that the gubernaculum, which should be attached to the lower pole of the testis and to the epididymis and adjacent portion of vas, may have been deficient as regards its attachment to the testis. In such a case the epididymis would be drawn down without a corresponding descent of the testis. It might also be argued that on account of a localized peritonitis or other inflammatory action, the testis had formed unnatural adhesions which interfered with its normal evolution.

In the course of an orchidopexy an effort should be made to determine whether the vas has joined the epididymis. As a rule these structures can be very well seen and felt through the peritoneal covering. If it is found that the vas has not united with the testis in the normal manner an anastomosis with the globus major should be performed,

according to the technique devised by Dr Edward Martin in cases of sterility following epididymitis. This is particularly desirable if the testis contains spermatozoa, which may be determined by aspirating the globus major with a hypodermic syringe.

It will readily be recognized that the defective development in these cases assumes a variety of forms, as well as marked differences in degree, all of which depends upon the primary defect as well as its extent in each instance. This will explain, I think, the conflicting views held by different writers.

My endeavor has been to emphasize —

1. That failure in the descent of the testis is due to developmental defects that take place very early in fetal life. The degree of the abnormality corresponds to the extent of interference in the formative period. As is well known prior to the fifth or sixth week the sex characteristics cannot be distinguished. It has seemed to me that in the condition here alluded to the impress of the stimulus that determines the sex has been deficient, so that the change from the primary indifferent stage has stopped short of perfection.

2. As a consequence there are definite anatomical defects observed in connection with the testis which may involve other structures derived from the same embryologic source.

3. As the majority of detained testes reach the scrotum by the time of puberty in the absence of complications that demand relief it would seem wise to postpone operations for transplanting the testis in the scrotum until ample time has been given the organ to descend naturally.

4. When operation is undertaken for any reason an effort should be made to trace the vas and if it is found not to be connected with the testis an anastomosis may be performed particularly if spermatozoa are present.

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CONGENITAL ECTOPIC KIDNEY AND HYDRONEPHROSIS ON THE LEFT SIDE, WITH A NORMAL KIDNEY ON THE RIGHT

WITH A REPORT OF CASE SHOWING THIS CONDITION

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A YOUNG MAN, 21 years old had always been in perfect health up to one and one half years ago. At this time he passed through a siege of "intermittent fever" accompanied by pain in the left lateral inguinal and lumbar regions and over the left hip. Up to date he has had at least twenty five similar attacks, except that the pain has grown worse and has been felt directly over the sacro iliac joint and definitely in the lower lumbar and inguinal regions on the left side. These attacks of pain have all begun gradually, have become quite intense, and lasted from two days to a week, finally abating. The patient at last consulted a physician. The physician thought he felt a movable kidney deep down in the left side of the abdomen and measured the temperature at 102° . With the diagnosis of "movable kidney and kidney colic" the patient was brought to the hospital after several days. At the time he came to the hospital there was only the slightest pain and tenderness, there was no rise in the temperature even over a period of four days, and no certain mass could be felt through an abdomen which was held rigid. The urine, highly colored with methylene blue contained only a few pus cells. An X ray picture showed no stone. The patient was in such good condition that he was discharged and asked to return, preferably during one of his attacks.

One month later the patient was brought back by his doctor and at this time was still suffering from the second attack since his first visit to the hospital. There was considerable pain in the back over the sacro iliac joint, over the lower abdomen, in the inguinal region and the spermatic cord on the left side. There was tenderness over the left side and a resistance suggesting a mass at about the level of the brim of the pelvis. The urine contained a number of pus cells. The temperature was 100° at three o'clock in the afternoon and rose to 102.4° by two o'clock the next morning. At the same time the pain became continuous and intense, necessitating morphine. The pain became less and less toward daylight, and the temperature fell to 99° and did not rise above this point during the next ten days. The urine passed in the morning was filled with pus cells.

An X ray picture had already been made during the first stay in the hospital and showed no stone. The ureters were catheterized four times during ten days. Each time the right catheter passed the ureter, but the left was halted about five inches up. One time a No. 7 catheter passed an inch or more

higher, and its passage was followed by a free dripping from the catheter of a lightly purulent urine. The time of appearance of phthalein was six minutes on the right side and over twenty minutes on the left. The output was about one fourth that of the right kidney. Bismuth catheters were inserted and another X ray picture made (Fig. 1). In this picture the bismuth catheter is seen obstructed about five inches up the ureter and the end is carried over toward the midline just below the promontory of the sacrum.

There was clearly an obstruction of the left ureter at the point where the catheter stopped, and a resulting hydronephrosis. The obstruction was thought to be intra abdominal and tuberculous glands were suspected, especially since there was present an indication of a mass, this was speculative.

The abdomen was opened through a left rectus incision, the patient put in the Trendelenburg position, and, with the intestines packed out of the way a retroperitoneal mass lying over the region of the sacro iliac joint was easily brought to view. On opening the retroperitoneal space and dissecting back the peritoneum, a thick walled cystic structure, covering the whole anterior aspect of the mass, was found. The mass, when opened, proved to be the much dilated and thickened pelvis of the kidney. This was continuous with a very short ureter, easily stripped down to the bladder. The ureter was cut and cauterized where it entered the bladder and, beginning with the ureter below, the mass was dissected bluntly from below upward. As it was raised a triangular area of kidney substance was brought to light, this occupied about one fourth the space behind and above as compared with the three fourths of the whole mass taken up by the pelvis. The main blood vessels reached the kidney at the upper pole and coursed downward and inward on the posterior surface in a groove between the pelvis and the kidney substance. The arteries were three or four small vessels derived from the aorta and the left common iliac.

Figure 1 shows the position and the outline of the kidney scratched on the X-ray plate. Figure 2 is a view of the anterior aspect of the kidney, showing the whole surface covered by the dilated pelvis. A small probe is passed up the ureter into the pelvis, a No. 7 catheter is admitted only on forcing. Figure 3 is a view of the posterior aspect of the kidney,

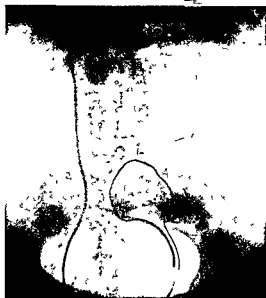


Fig 1 Position and outline of kidney

showing a triangular mass of kidney-substance at the upper pole. Four small straws inserted into the arteries indicate their course.

(1) The location of the kidney just over the brim of the pelvis is that reached in the ascent of the kidney at about the seventh week of foetal life. (2) The anterior position of the pelvis is also that of the sixth to seventh week of foetal life, before rotation in the transverse direction has taken place and before the kidneys become abdominal organs. (3) The ureter is very short and free from kinks and twists, its length being probably determined by the low level at which the kidney became fixed during its foetal ascent. (4) The vessels are short, several in number, they enter at the upper pole and are picked up from the surroundings. (Dr Jeldell, of the anatomical laboratory of the Johns Hopkins University, has shown that the capillaries of the kidney bud probably com-

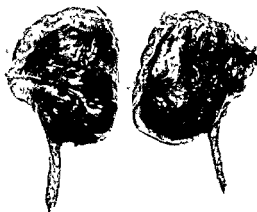


Fig 2 Anterior aspect of kidney

Fig 3 Posterior aspect of kidney

municate with the capillaries of the neighboring regions as the kidney passes upward. New capillary anastomoses are thus formed at the upper pole as it ascends, while those at the lower pole atrophy. All these points in pathology of embryological origin point clearly to a failure to ascend, or, as it is wrongly spoken of, to a "congenital descensus."

The exact cause of the hydronephrosis is not clear. The opening from the pelvis into the ureter is very small and there was an abrupt angulation of the ureter on the pelvis. Just how this structure worked when filled with fluid under pressure, I cannot explain, much less can I explain why this condition lay latent and gave no symptoms for nineteen and one-half of the patient's twenty-one years of life, especially when it is considered that the primary condition began thirty-four weeks before the patient was born.

I am indebted to Drs A J Crowell and J W Squires of this city—to Dr Crowell for recatheterizing the ureters and assisting at the operation, and to Dr Squires for the X-ray pictures.

OBSERVATIONS ON THE OPERATIVE TREATMENT OF SALPINGITIS¹

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THIS paper comprises a series of 328 cases, and it has been my privilege to observe many more while at Rotunda Hospital and in the work of my seniors at the Wesley Memorial Hospital, the latter of which came previous to the greater part of my personal cases.

Etiology. The largest etiological factor in this series of cases was the gonococcus; from the history in some patients and vaginal smears in the others we found 197 instances where we felt certain of the diagnosis. There were 43 cases of puerperal origin, 35 of which followed criminal abortions, leaving 86 cases due to other infective organisms, examination of the pus removed from the tubes invariably returned a negative report. Four cases in this series were tubercular, although we had 3 others which are not included for reasons which will be given later. In 12 cases we found the appendix firmly attached to the right appendages, and in 5 of these we felt that it was the cause of the oophoritis and cellulitis. Four cases were secondarily infected with the colon bacillus.

Pathology. The pathological range in salpingitis is very wide, there being, first, the chronic inflammation of the tubes and ovaries without pus formation; second, the cases of hydrosalpinx, third, those cases where the tubes are bulbous at the fimbriated end and contain a fluid thicker and denser than that of hydrosalpinx, but not of the thickness and consistence of pus, with the ovaries more or less cystic and enlarged showing evidences of inflammation, fourth, the cases of pyosalpinx of varying degree in which there is a moderate amount of destruction of one or both ovaries by abscess formation, fifth, the typical tubo ovarian abscess with its complete destruction of the organs.

Adhesions play a very important part in the pathology of salpingitis and bring the organs into many different positions, the tubes become adherent posteriorly to the peritoneum, rectum, and uterus, and at times

to each other — in several instances they were adherent anteriorly to the uterus and bladder — the tubes adhere to the ovaries and these in turn act as a plug preventing the escape of pus from the fimbriated end. The ovaries were adherent in all cases to the posterior parietal peritoneum and to the broad ligament where pus or a large cyst was present, and always adherent in other instances to the broad ligament.

In chronic salpingitis with little or no pus, the adhesions of the tubes and ovaries to the uterus, broad ligaments, and peritoneum were so dense that in most cases it appears as though the structures were grown together, and it is impossible to separate the ovaries from the broad ligament without tearing them or removing that part of the broad ligament where the attachment has taken place. In pyosalpinx and tubo ovarian abscess, as a rule, a line of cleavage can be found making the separation quite easy, and furthermore the broad ligaments increase in thickness and density and can withstand a great amount of trauma without tearing.

The intestinal and omental adhesions differ largely in degree, the amount of intestine involved, and the density of the adhesions. We have had very little and easily separated bowel and omental adhesions to the uterus, tubes and ovaries, and bladder, and from this on up to the instances where it was impossible to separate the adhesions of a tubo ovarian abscess without entering the bowel. In one of our cases there was a patulous opening between the bowel and abscess cavity. By far the worst adhesions were found after puerperal cases and usually between the ovarian abscess and the intestine.

In some cases the intestines and omentum become adherent to the fundus and anterior wall of the uterus and bladder and form an awning over the entire pelvic organs. The most destructive pathology follows puerperal infection, and in this the ovary is destroyed by abscess formation, probably due to the

fact that the infection is carried directly to the ovary through the lymphatics and attacks it with its full intensity, and by the germs themselves, while with ordinary salpingitis the drippings of pus from the sim-briated ends wash over the ovary and cause an inflammatory reaction which results in cyst formation rather than abscess. Where the bacteria reach the ovary through the tube and do not cause pyosalpinx they do not, as a rule, produce ovarian abscess. Secondary infection with colon bacillus adds to the pathology in that it increases the peritonitis greatly and lowers the resistance of the tissues markedly. Fibroids occurred in 9 cases. There was one double dermoid of the ovaries. There were no cases of ruptured pus tube in the acute stage.

The appendix was attached to the right appendages on twelve occasions, in seven there was a marked salpingitis, while in five it appeared as if the appendix caused the infection and abscess on the right side, because the left was apparently normal. We make the above distinction, feeling that salpingitis is always double, and although the appendix was attached in seven instances it was not the etiological factor, the inflammation of the appendix following its attachment to the ovary or tube.

TREATMENT

All operations were performed after thorough subsidence of the acute stage. We have divided the cases under consideration into two groups, first 161 in which the tubes, ovaries, and uterus were removed either by panhysterectomy or supravaginal hysterectomy. In the latter we amputated down to the vaginal wall, leaving as little of the cervix as possible. In this group of cases the pathology of the tubes and ovaries demanded their complete removal and from my experience I am convinced that a supravaginal hysterectomy is a justifiable procedure in these cases. Panhysterectomy was performed in 19 cases, where the cervix was large and soft and in tuberculosis of the organs. The ultimate results were no better than a supravaginal hysterectomy, so we would not recommend it as a routine procedure.

Of the second group comprising 162 cases, various operations were done, namely:

Both tubes removed in all cases. In addition to this, in four the ovaries were removed and the uterus left, in 11, the uterus and one ovary were removed, in 36, the uterus and both ovaries were left, in 6 of which the ovaries were left *in toto*, in 21, one ovary was resected, in 9, both ovaries were resected. In 111 cases the uterus and one ovary were left, and in some of these the ovary was resected slightly or very small cysts were punctured; of these there were about 40. The 5 cases caused by the appendix, the appendages on the right side were removed in 4, and in 1 a supravaginal hysterectomy was done. Owing to the presence of fibroids in the uterus, the ovary on the left was not removed.

In operating on above group of cases our chief concern at the time of operation was what to do with the ovaries. In all cases both ovaries were affected to more or less degree, both were cystic or adherent to the tube or broad ligament with or without cyst formation. In some instances after freeing the ovaries from adhesions they looked to the naked eye comparatively healthy. As stated before we believe salpingitis is always double, still not two tubes in the same individual are exactly symmetrically affected as we see them on the operating table, and the same is true as to ovaries, if one ovary is plainly diseased from the salpingitis so is the other, although macroscopically it may appear in good shape either as a whole or in part, and although the source of infection be removed it does not follow that the infection has been removed from the ovary. We may therefore reasonably expect cystic degeneration in the ovary that is not badly affected at the time of operation. Many cases present themselves in which both ovaries are affected to some extent by the infection, and the problem is whether to leave one ovary or a part of one to preserve menstruation and other functions. It is a hard guess to say which one is less likely to degenerate and become cystic or have abscess formation. In our experience a goodly number do become cystic and require further operative work, and

this in a comparatively short time — some as early as 6 months and so far never longer than 3 years. Those who do not return to us for a second operation are not necessarily cured.

Of the above group of cases which were treated with the object in view of saving as much as possible of both ovaries, forty-four cases have returned to us in which the subjective symptoms and objective findings warranted a second operation. The main subjective symptoms were a continuation of the pain in one or both sides, menorrhagia and dysmenorrhœa, and persistence of the leucorrhœal discharge. These symptoms, coupled with the finding of a mass on one or both sides of the pelvis, showed a recurrence of the disease in the ovary or ovaries, the leucorrhœa of a large amount showing that the infection still persisted in and about the uterus. At the primary operation in the 44 cases, both tubes were removed in all, one ovary and uterus left in 24, both ovaries and uterus in 18, and the uterus alone in 2 cases. At the second operation in all but 4 the remaining ovarian tissue was removed with the uterus (supravaginal hysterectomy). In 4 cases resection of one ovary was done and up to date two of these have had their third operation. One of these cases had a persistent abdominal fistula from a resected degenerated cystic ovary which was left deep in the pelvis; the fistulous tract persisting for 5 months. One other case had a fistula for 8 months from a degenerating ovary after both tubes, uterus, and right ovary were removed, this occurring after primary operation. Another case died of peritonitis after secondary laparotomy, where there was a secondary infection with colon bacillus of both ovaries and uterus. A number of cases are at present under observation which have been operated but which are anything but cured of their pelvic disease.

We have found that a resected ovary or one that has required considerable manipulation to free it from its adhesive attachments is in the great majority of cases a constant source of pain to the patient and is very prone to become cystic and degenerated. Leucorrhœa is one of the most prominent symptoms we have to deal with, and very little improve-

ment has been noted in this condition unless a supravaginal hysterectomy has been done.

Respecting fully the opinions of many authors as to the importance of the ovary, we have not taken the stand whereby the ovaries should be removed in all cases of salpingitis, on the other hand, a large percentage of those ovaries which in former years we left wholly or partially intact are now removed, and this radical treatment is really the most conservative one, as it does away with the possibility of a second laparotomy and its inherent dangers, the latter being a very large price to pay for six months to three years of menstruation, furthermore, the patients are not well in the interval between the first and second operations. The physiology of the female generative organs is so regulated that menstruation occurs from puberty to the menopause, or during the so called childbearing period of a woman. Cases have been reported where conception has taken place before puberty, and when the woman is still in the menopause, but with anatomical conditions present which absolutely prohibit the union of the ovum and spermatozoa, these exceptional cases are not to be considered. We are perfectly secure, then, in our statement that when a woman reaches the climacteric she becomes automatically sterile. What effect normal menstruation has on the general health and physical welfare of a woman cannot be answered for the adult, while for those still in the adolescent period some serious consequences result from an early oophorectomy. Since the physiology of the female generative organs is so controlled that when a woman reaches the age beyond which she cannot safely bear children the process of menstruation ceases, then why not assume that if for any just cause a woman is rendered sterile through a necessary operative procedure, she be placed immediately into the menopause by removing both ovaries, eliminating any chances for the development of future cystic condition, by removing the uterus, thus eliminating any possibility of a chronic endometritis, the means by which the infection no doubt reached the fallopian tubes, and by removing the possibility of a mere postponement of

the cessation of the menses? The diseased ovaries surely must have their functions impaired, and if the condition is very severe or of long standing the constitutional symptoms attendant upon the menopause or double oophorectomy have been going on during the course of the disease, and plus this the symptoms due to the infection of the pelvic organs with the toxemia attending such a condition, must be greater by far than the effect of the removal of the ovaries. The patients upon whom oophorectomy has been performed are infinitely better than before the operation, not taking into consideration the immense improvement locally in the pelvis.

The above statement regarding the impaired function of the diseased ovary is made, knowing full well that many women have become pregnant and have menstruated with ovaries that contain neoplasms of all kinds, and also after the ovaries have been resected. If other diseased organs of the body have their functions impaired, can we make an exception of the ovaries? And other organs are removed *in toto* provided they are not essential to the very life of the patient. Saving the ovary for pregnancy is entirely eliminated in the subject under consideration, and this brings us down to menstruation. The fact that they did not menstruate disturbed our patients mentally very little and they easily became reconciled when the facts were put before them and they understood the situation. Some patients who thought favorably of pregnancy were satisfied when it was explained to them that although menstruation was preserved they could not become pregnant. With another class of patients they were happy with anything that excluded the possibility of pregnancy. We have been agreeably surprised at the small number of patients who after their operation complain of nervous symptoms which might be attributed to the removal of the ovaries, the nervous phenomena of menopause far exceed the above in duration and severity and yield far less readily to treatment.

Operative treatment. Every operation is started on a line of procedure which we have systematized, and this plan is carried out with such little deviations as the individual

cases may demand. With the patient in the Trendelenburg position all operations are done through a median abdominal incision, large enough to give a good exposure to the field of operation. The incision starts at the pulus, the muscle and fascia being incised down to the bone, the loose intestines are pushed back and the upper abdominal cavity protected as much as possible with a five-yard roll of gauze. The campaign is at once directed to the uterus with the idea in view of exposing it thoroughly and freeing it of all its adhesive attachments anteriorly and posteriorly the latter down to the cul de sac. It is very important to separate the adhesions on the posterior wall of the uterus thoroughly until one has exposed the cul de sac. The uterus is grasped as soon as the fundus is seen after opening the abdomen, and during the operation traction is made bringing the operative field up out of the cul de sac. Following this the intestinal and omental adhesions to the tubes and ovaries are dealt with, the intestinal ones are carefully separated if possible, the omental adhesions are separated or cut and ligated. The tubes and ovaries are brought out of the pelvis by working upward and outward posterior to the uterus and starting from the lowest point of adhesion and keeping close to the tumor mass. Where the intestinal adhesions are so dense that they do not separate readily from the mass the tube and ovary are separated from the uterus and other structures and brought outside the abdomen, thus giving more freedom of action. In nearly all cases the separation is accomplished without injury to the bowel. If there was a possibility of entering the bowel, the mass was cut away, leaving as little as possible of the abscess wall attached to the intestine. Adhesions between loops of intestine were not disturbed unless there was evidence of a possibility of obstruction. In dealing with the pathology where the uterus was left the tubes were removed by clamping off the broad ligaments as nearly parallel to the tube as possible, if the ovary was included the clamp was placed below it. All raw surfaces were covered by pulling up the infundibular pelvic ligament and the round ligament, the latter being shortened—

a great aid in keeping the uterus antiflexed. This method of covering the raw surfaces also has the tendency to prevent the prolapsing of ovaries that are left. One catgut suture is used on each side to replace clamps and cover the raw surfaces. When a hysterectomy is done the round ligaments are clamped, cut, and tied about one-half inch from the uterus, the bladder-peritoneum is dissected away from the uterus, the broad ligaments are clamped, saving as much of them as possible. With one double strand of No. 1 catgut, about 30 inches in length, we replace all clamps and cover up the raw surfaces, two knots are tied, the first after ligating the broad ligaments and the second after covering up. Our method of dealing with the round ligaments and bladder-peritoneum allows us to bring the cut ends of the round ligaments together in the center of our field, and gives us an abundance of peritoneum to be used in covering over raw surfaces without putting any tension on the structures that are used in the process.

The modified figure-of-eight suture, described by Dr. Watkins last year in a paper before this society, is the basis of all our suturing and makes the method used in the hysterectomy possible. If an ovary is left we believe it is best to leave the uterus in its entirety, because the ovary is thus left in a more normal position, where the circulation is less likely to be impaired and where the resistance is kept up to normal standards. In this position, should it require removal later on, the operation is far more simple and attended with less trauma and danger than if it were situated deeper in the pelvis, where it would become imbedded under the broad ligament and surrounded by dense adhesions. Resected ovaries were sutured with fine catgut on fine needles and with as little trauma as possible, small cysts were punctured with a Hagadorn needle, there being a possibility that the handling and suturing may be a factor in causing these ovaries to become cystic. When pus was spilled in the pelvis, drainage was obtained by packing the cul-de-sac with a gauze strip which was brought out through the vagina by incising the cul de sac from below after the abdomen

was closed. Drainage through abdominal incision was never used. We consider the pus in these cases practically sterile, where no bad odor exists, but still drained because we felt there would be less reaction to the patient and because drainage insured a quieter convalescence.

After the operation the pelvis was never treated with antiseptic drugs, and nothing was done to prevent adhesions, except that the most careful technique was used in covering the raw surfaces and in leaving the intestinal adhesions alone, as stated before in this paper.

In tubercular salpingitis our results have been very unsatisfactory, though at the time the cases impressed me as being favorable ones for operation, judging from the pathology present and the general condition of the patient. Of the four cases operated upon not one is living, one who did not rally from the effects of the operation, died four days after, one died in six weeks, having developed a faecal fistula, one in six months, the abdominal wound draining profusely the whole time and the patient remaining continuously in the hospital. The last one, a very favorable case apparently, early in the disease, left the hospital in three weeks in excellent condition but died eight months later from a tubercular meningitis.

In our last three cases we have, after opening the abdomen and noting the condition present, simply removed tissue sufficient for laboratory work and then closed the abdomen. This attitude is not assumed after a series of four cases which I personally operated on, for my observations extend a good deal beyond that. One of the last cases is living and doing quite well and it is upward of two years since the diagnosis was made. I have lost trace of the other two cases.

Cystitis occurred in a number of cases, but was of little consequence and readily responded to treatment. Several of our cases had acute attacks of colitis from 2 to 4 weeks after operation, which were severe enough to confine them to bed for a week to ten days, some returning to the hospital. The symptoms were severe colicky pains in the lower abdomen, frequent stools containing mucus and blood, with a slight rise of temperature.

Thrombophlebitis occurred in two cases and in both the condition was confined to the left leg. The swelling and edema came on rapidly, reached its height in about eight days, and the whole limb was involved. This prolonged the convalescence for three to four weeks and it required months for the limb to return to its normal size.

Three cases returned to us with ventral hernias, two of which had wound infection and suppuration, and the third had primary union. This case was operated upon for the hernia, and on removing the skin stitches on the eighth day the wound opened exposing the intestines, necessitating re-suturing. The original catgut suture still held, but the fascia split the whole length of the right side of the wound where it had been punctured in putting in the catgut suture.

There were three deaths, not including the tubercular cases. Death was due to peritonitis. In two there had been a secondary infection with colon bacillus upon old gonorrheal tubes. One case died sixty hours after the operation from peritonitis. This case

was not under observation before operation, but was represented to me as an old chronic case. I have always felt, however, that she was having a very acute attack at the time, judging from the conditions found at the time of the operation.

The prognosis as to the life of the patient impresses me as being very good in this condition, especially if one waits for the acute symptoms to subside, waiting at least eight days after the temperature has returned to normal before operating. In tubercular salpingitis the prognosis is not good for a cure of the condition or the life of the patient. For resected or whole ovaries that are left, the prognosis should always be very guarded as they are very prone to be painful and become cystic and require further operative work. Salpingitis severe enough to demand operative interference should include an oophorectomy and supravaginal hysterectomy.

I wish to thank Dr. Payson L. Nusbaum for his assistance in the pathological work and development of the operative technique.

DEPARTMENT OF TECHNIQUE

A VACUUM APPARATUS FOR SUPRAPUBIC DRAINAGE

By EDWIN G. DAVIS, M.D., BALTIMORE
Resident Surgeon, Union Protestant Infirmary

BY means of the apparatus described below, the urinary drainage following suprapubic cystostomy is disposed of, the patient being kept entirely dry and the necessity for frequent changes of dressings and bed linen being obviated. The principle of the method involves the production of a slight but constant suction within a catheter in the bladder, by means of a vacuum bottle, which is allowed to become exhausted very gradually and which is taken from the bedside and renewed when necessary. The vacuum bottle is connected by a rubber tube to an air-tight urine bottle, and the latter, by a second piece of tubing, to a catheter in the bladder. Between the two bottles is a regulator, which permits but a very small stream of air to leak into the vacuum, thus gradually exhausting the air in the urine bottle and making the pressure there slightly below atmospheric pressure. This produces a mild suction within the catheter in the bladder, and the urine is drawn out and drips down into the urine bottle, replacing the air which has leaked into the vacuum.

Two bottles are necessary, an eight-liter vacuum bottle (V) and a two-liter urine bottle (U), each provided with a two-hole rubber stopper and with pieces of glass tubing of a shape as shown in Fig. 1. Catheter (C), in the end of which are multiple perforations, is inserted into the bladder through the suprapubic incision and by rubber tubing is connected with bottle U, which in turn is connected with bottle V. The catheter is held in place by strips of adhesive upon the abdomen, and the tube is supported by a safety pin and adhesive as it passes over the edge of the mattress. A sudden rush of air from U to V, with a consequent immediate exhausting of the vacuum, is prevented by the capillary regulator (CR), which hangs suspended within V, and which is shown in detail in Fig. 2.

The capillary regulator is made up of the following parts. The outer protecting sheath is a glass tube about 10 cm. long and about 1 cm. in diameter, with a constriction at the middle, as

shown in Fig. 2. At either end is a rubber stopper held tightly in with a screw cap, as it would otherwise be forced out by the air pressure. Passing through each rubber stopper is a short piece of glass tubing, the lower one of these being drawn out to form an exceedingly fine capillary tube (CT). The air, coming from U, first passes through the tightly packed cotton plug (P), where it is filtered, and then it slowly forces its way through the capillary tube (CT), and on into the vacuum. The success or failure of the entire apparatus depends on the caliber of this delicate hairlike tube, the lumen of which is too small to be seen without the low power of a microscope. This minute opening regulates the air-flow, permitting but a very gradual leakage of air from U to V, so that a slight but constant suction is kept up within U, by means of which the urine is drawn through the catheter and rubber tube and slowly drips into the receptacle. In place of the outer glass tube shown in Fig. 2, the glass barrel of an antitoxin syringe may be used temporarily, a cotton plug being glued in the upper end and the rubber stopper and capillary tube being secured by adhesive in the lower end.

METHOD OF RENEWING VACUUM

The vacuum bottle may be disconnected at joint (J) and the vacuum renewed when necessary, the air being exhausted through stop cock (SC) by means of an ordinary hydraulic suction pump or filter pump such as is possessed by most hospitals and laboratories. These pumps are very simple and may be cheaply purchased with an attachment to fit on any faucet (see Fig. 3). The vacuum produced in an eight-liter bottle by running the water through one of these pumps for about four minutes will last from twenty-four to thirty-six hours, provided the capillary tube is the proper size. When the air has been exhausted from the vacuum bottle, the latter is carried to the bedside and attached to the urine bottle and need not be touched for at least another twenty-four hours.

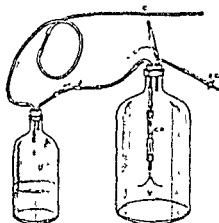


Fig. 1. Entire apparatus in position.



Fig. 2. Capillary regulator.

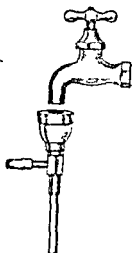


Fig. 3. Suction pump.

Indicator (I), shown in Fig. 1, is a short piece of thin walled rubber tubing attached to the V tube in the stopper of the vacuum bottle and plugged at the other end. This is collapsed by the outside air pressure when a vacuum exists, and bends over, but when V becomes filled with air the tube becomes distended and stands erect, indicating that a renewal of the vacuum is necessary. The remainder of the rubber tubing used on the apparatus should have walls of sufficient thickness to withstand the air pressure.

METHOD OF MAKING CAPILLARY TUBE

As stated before, the exact size of the capillary tube is all important. Too rapid a leakage of air from U to V would not only make frequent renewals of the vacuum necessary, but would cause a dangerously violent suction within the bladder. On the other hand, too mild a suction would permit drainage of urine over the abdomen. The making and testing of these tubes is a rather difficult, complicated procedure, and is impossible unless one devotes to it considerable time and careful attention. Arrangements have been made to put the apparatus on the market, but I include, nevertheless, a description of the method for anyone who may wish to attempt it.

First, a piece of glass tubing is drawn out to a point, and then this point is redrawn once or twice until a fine flexible hairlike thread, with no visible lumen, is obtained. In doing this the attempt should be made to make the tube as fine as possible. The next step is to determine and regulate the rate of air flow through this minute lumen, which is done by drawing a stream of air through the tube and causing the air to pass through water, the number of bubbles per minute being counted. In making this test a large vacuum bottle, in the bottom of which there is water to a depth of about 10 cm., is used. A long straight piece of glass tubing passes through the rubber stopper and down to the bottom of this vacuum bottle, the lower end being therefore about 10 cm. under water. To the upper end, which extends out of the bottle, is attached, by a short piece of rubber tubing, the large end of the capillary tube which is to be tested. Air entering through the capillary tube must then pass through the water on its way into the vacuum, the rate being determined by counting the number of bubbles per minute. Since the rate of air flow varies widely with the strength of the vacuum, I have taken as a standard a vacuum that will sustain a column of mercury 60 cm. in height.

Therefore, in order to standardize the vacuum, it is necessary to have it connected with a simple mercury manometer, consisting of a dish of mercury and a perpendicular glass tube about 75 or 80 cm in height. The caliber of capillary tube that will give satisfaction has been found to be one that will permit about 70 or 80 bubbles per minute to pass through a depth of water of 10 cm into a vacuum that will sustain a column of mercury 60 cm in height. One can easily make the capillary tube too small, that is, so that the rate of air flow is perhaps only 10 or 20 bubbles per minute. Then small bits may be snipped off the delicate tip with a pair of scissors, the increase in rate of air flow caused by this being carefully watched until the proper number of bubbles per minute is obtained. The capillary tube, having been tested, is now fitted in a hole in a rubber stopper and is ready to be permanently inserted in the protecting tube, as shown in Fig. 2. The cotton filter (F) is essential, as the capillary tube would otherwise become clogged. Just before permanently inserting the capillary tube in its place, it is advisable to draw a strong current of air through the cotton filter with the suction pump, thus removing any fine particles that might be in the cotton. The stoppers are next securely fixed with the screw caps and the capillary regulator is complete. It is essential that these stoppers be absolutely air-tight.

In using the apparatus some precautions are necessary. In those cases complicated by a severe cystitis, the clogging of the catheter by mucus and pus may be prevented by daily irrigations of the bladder. The urine bottle must be emptied before it has become entirely filled, lest the urine be drawn over into the air tube and the capillary tube clogged and ruined. For the same reason it is necessary that, of the two tubes end-

ing within the urine bottle, the one from which the urine drips be the longer. Rubber stoppers must be kept tightly in bottles. The capillary regulator must be handled with care, as the delicate tube is easily broken. Once it is suspended within the vacuum bottle it is in a safe place and may remain permanently undisturbed. A dressing upon the incision tends to become wet by capillary attraction, and for this reason it is better to paint the stitches with iodine and leave the incision entirely uncovered. The apparatus may be applied within the first twenty-four or forty-eight hours after operation, that is, as soon as there are no longer blood clots in the bladder. After about two weeks the sinus has granulated tightly around the catheter and when the latter is removed the sinus closes very rapidly.

The advantages of this drainage method, both to patient and to hospital, need not be enumerated. Those cases that develop ammoniacal urine derive special benefit because, by the constant suction, the bladder is kept empty and is thus saved from continued contact with ammoniacal urine. Furthermore, the short time that the urine is allowed to remain in the bladder is not sufficient for it to decompose and develop ammonia. The complete absence of urinous odor, even when the bed clothing is turned down and the incision examined, is worthy of mention. The apparatus may be applied to bedridden patients with biliary fistula, or fistula of the first portion of the small bowel, where there is a profuse fluid discharge, irritating to the skin. I have had no opportunity to try it on a pancreatic fistula.

I am indebted to Dr. George Walker for helpful suggestions and for his kindness in permitting the use of cases in making the necessary preliminary experiments.

DILATATION IN URETERAL FISTULÆ¹

By WILLIAM WARREN TOWNSEND, M.D., F.A.C.S., RUTLAND, VERMONT

THE causes of ureteral fistulæ are well known. They originate from internal and external sources; the former may be either tuberculous or malignant ulceration, which finally leads to perforation, or the pressure of an impacted stone which destroys the wall of the canal either by mechanical perforation or in a sloughing process resulting from the pressure. Of external causes one of the most familiar and longest known is pressure upon the ureter by the fetal head during protracted or difficult labor. So-called traumatic fistulæ are due as a rule to accidental division of the canal in the course of operations involving the parametrium. The urine escapes into the neighboring tissues and induces abscess formation which points either outwardly or discharges into one of the hollow viscera. The fistulous opening may be longitudinal or transverse. The longitudinal openings are associated with leakage from the side of the canal, and for a time, until partial repair or stricture occurs, some urine may be directed normally, as happened in the case of Jeanbrau to be reported later. After transverse division the upper segment shows a strong tendency to retract. Multiple fistulæ have resulted at times from the discharge of an abscess in different directions. For example, cutaneous, genital and intestinal fistulæ occasionally coexist. When the ureter has been severed and the ends of the two segments lie in the abscess cavity the inferior of the two gradually undergoes atrophy.

Basing our opinion on the three cases to be reported, we believe that a certain percentage of ureteral fistulæ may, if seen sufficiently early, have the "tide turned" so that extensive operative procedure may be eliminated. Case reports are exhausting, but in order to illustrate the position of dilatation in ureteral fistulæ we will ask you to pardon the abstracts taken from the hospital records of the following cases.

CASE 1. Mrs. M. operated on at the Rutland City Hospital for a large uterine fibroid; a supravaginal hysterectomy was done. At the time of operation an annoying hemorrhage occurred from an enlarged branch of the uterine artery and the surgeon clamped *en masse*, later separating and tying off the vessels individually. One week following, urine was found to be soaking the vaginal pads, and an examination showed it to be coming from the stump of the cervix. We were asked by her physicians Drs. Crain and Gale to cystoscope and catheterize the ureter in order to determine the function of the left kidney,

as a repair to the ureter or a nephrectomy was being considered. We found that a No. 7 catheter passed readily to the kidney of the left side, and the same sized catheter passed a cm. into the right side before meeting obstruction. Within a few hours it was quite apparent that there was less drainage. This was estimated by comparing the number of soiled pads in a given time. At the end of the first week it was calculated to be less than half the quantity drained prior to catheterization. This result encouraged the patient and her physician to a further attempt at dilatation. At this time we used a No. 10 French catheter, and much to our surprise it passed over the obstruction and on into the kidney pelvis. The patient would not consent to our leaving it in, so it was reluctantly withdrawn. Following this dilatation the drainage by the vagina ceased entirely, and a subsequent cystoscopy and ureter catheterization showed an equal quantity of normal urine coming from both ureters. At the present writing the patient is enjoying perfect health.

CASE 2. Mrs. H. operated on at the regular gynecological clinic of the medical college of the University of Vermont for a large ovarian cyst. During its removal the right ureter was torn and an end to end anastomosis was immediately done by the operating surgeon, Dr. P. M. McSwenny. Several days later, urine was noted on the abdominal dressings and it grew more profuse daily. We were asked to determine the condition of the kidney on the opposite side and after estimating its output we passed a catheter into the right ureter, it passed 3 cm. and then met with obstruction. After making moderate pressure it "rode" the obstruction and passed to the kidney pelvis through it a continuous flow of urine came which suggested a beginning hydroureter. We decided to leave the catheter in and the drainage immediately ceased through the abdominal incision. 352 ccs. of urine drained through the catheter the first twenty-four hours. At the end of a week, as the patient was dry and comfortable, Dr. McSwenny, believing that it would be safe to remove the catheter, did so, within an hour urine appeared in the abdominal incision. The following week when we went to Burlington we tried to repeat our former performance of passing a catheter up the affected side but were unable to do so and catheterizing the stump failed to bring any urine through the catheter. A nephrectomy was finally done on the case after an unsuccessful attempt at repair of the ureter was made. At this time it was impossible owing to extensive adhesions to make out what the path dogs might have been as all surgical landmarks were lost.

I believe this case would have gone to a successful end had the catheter been left in the ureter until the abdominal wound had healed.

CASE 3. H. N. referred by Dr. R. S. Macdonald of Plattsburg, New York, was operated for an appendiceal abscess in 1908. The appendix was not removed, the abscess was drained and an uneventful recovery was made. In September 1911 he developed symptoms of intestinal obstruction and a mass was discovered in the right iliac region. In October 1911 Dr. Macdonald cut down on it, pus was found and a vigorous hunt was made for the remnant of appendix. During the search the ureter was

¹ Read before the American Association of Genito-Urinary Surgeons, White Sulphur Springs, West Virginia, May 28-30, 1915.

exposed and must have been injured, but the injury was not recognized for in five days urine came from the abdominal wound. At this time we were asked to see him for the same reason as in the previous cases, namely, to determine the function of the kidney of the opposite side. The catheter passed to the left kidney pelvis. The right catheter met with obstruction after passing 10 cm., and the urine came through the catheter. I was gratified to learn from the doctor that two days following this dilatation no urine came through the wound. The abdominal wound healed and the young man is in perfect health and has perfectly normal urine coming from both ureters.

In a review of the literature we found but four cases that approximate the above experiences, namely, the cure of ureteral fistulæ by dilatation, and while in two the method of approach for dilating was different, the principle involved was the same.

A case reported by Jeanbrau (1) and believed at that time to be unique was that of a woman who soon after marriage showed evidence of marital infection. A posterior colpotomy was done to drain a pelvic abscess, following which a ureterovaginal fistula developed. Urinary segregation showed that the left ureter was the leaky one, as there was but a small quantity of urine coming from it as compared to the right one. Jeanbrau put a catheter in the ureter and left it for six days, no more urine drained from the vagina. He concludes his article, which is given in great detail, by stating that he later operated on the patient and removed the uterus and adnexa.

Seiffart (2), in reporting a case of uretero-abdominal fistula, stated that he cured his case by catheterizing toward the bladder through the abdominal wound, and was surprised to find that "he had restored the connection between the kidney and bladder." He accomplished this result by gradual dilatation of the inferior segment daily. After four months of such treatment the abdominal wound filled in, "the distance between the two ureteral ends became lessened, and finally the urine took a normal course."

Albarran (3) reported, at the surgical congress at Lyons, his results in the treatment of a ureteral fistula due to a calculus which had become impacted at the pelvic narrowing of the ureter. An abscess formed with a resulting abdomino-ureteral fistula. He cut down on the ureter, which, to quote his article, he found "so inflamed and embedded he could not think of suturing it." He removed the calculus and then went into the bladder suprapubically, he passed up ureteral dilators to the kidney pelvis and then put in a retention catheter through which "the

kidney pelvis was washed out." His case made a good recovery. He concluded his remarks by stating that in a certain number of these ureteral fistulæ the kidneys could be saved by this process.

Boeckel (4) reported the case of a woman, age 45, who was operated on November 4, 1911, a Wertheim operation under spinal analgesia being done. The case went well for eighteen days, then urine began to escape by the vagina, and a diagnosis of uretrovaginal fistula was made. After a number of efforts a ureteral bougie was passed up to the kidney pelvis, the following day a larger one was passed, and lastly a catheter was introduced on December 24 and allowed to remain until January 2. When the case was last heard from, April 13, she was doing well, and no urine was coming by the vagina. The author stated that he knows of no similar case except that of Jeanbrau, which has been referred to by us.

As was stated in the abstracts of our cases, catheterization was carried out not for curative but for diagnostic purposes, i.e., to determine the functional capacity of the kidneys. The pathology was quite unknown, as in two cases no abdominal section was made, and in the case of Mrs. B, as stated, it was impossible to determine what the pathology was.

Undoubtedly, many of us have had similar experiences, but the reports of their cases have not found their way into the literature, and we tender the paucity of reports as an excuse for calling the attention of the members of this association to this simple procedure. As regards the possible danger of catheterizing the ureter in the class of cases reported, for fear of infection or untoward trauma, we believe it to be theoretical. There should be no danger of infection or trauma if precaution and care are exercised.

Some authorities write in a general way of spontaneous healing as a termination of ureteral fistula, others such as Guiteras emphasize the infrequency of this outcome. Personally, we believe that the spontaneous cure comes about as a result of hydronephrosis and atrophy of the kidney, thus shutting off the secretion. This could not have been the outcome in our cases, as cystoscopy has shown that urine comes from both ureters.

In conclusion, the fact that the distal segment of the ureter undergoes atrophic change within a relatively short period appears to indicate that the early trial of dilating the stump through the bladder in a rational attempt to preserve its

integrity may save the kidney or a ureteral anastomosis. In urethral fistula we know that any stenosis will cause perpetuation of the fistula. In such cases dilatation of the stenosis aids in closing the fistula; we believe it to be so in ureteral fistula, and we trust that in the report of these cases we may stimulate the members of this association to a trial of this

method, and the subsequent publication of their results.

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ACUTE TORSION OF THE RIGHT INTERABDOMINAL SPERMATIC CORD, THE SYMPTOMS OF WHICH SIMULATE ACUTE APPENDICITIS

By RALPH C. CLEVER, D.D., M.D., CHICAGO
Surgeon, St. Anthony's Hospital

I HAVE recently had occasion to witness an interesting case which presented the symptoms of acute appendicitis or torsion of the right interabdominal cord.

The patient, a strong adult male, entered St. Anthony's Hospital at 8 a.m. November 1, 1911. He had had no previous abdominal symptoms. His present trouble began about 1 a.m. on November 1, 1911. He presented the classical syndrome of an acute abdominal crisis. Examination showed the absence of the right testicle. It had never appeared in the scrotum or inguinal canal. Pain came on suddenly, was severe and was followed by vomiting, rapid pulse, tenderness and rigidity in lower right abdominal region, elevation of temperature and a leucocyte count of 15,000. Differential white count was not recorded.

The diagnosis of acute appendicitis or torsion of the right interabdominal spermatic cord was made at 8 a.m. the following day. The abdominal cavity was opened by retracting the fibers of the rectus muscle inward. The testicle was located midway between the umbilicus and the anterior superior spine of the ilium. The testicle moved freely, being suspended by the spermatic cord. The cord contained two complete rotations and by reason of this had occluded the blood supply to the testicle. The structure involved showed that the process was acute, and the testicle presented the appearance of gangrene. The cord and testicle were removed. The appendix was normal.

This condition should be considered in the diagnosis of acute appendicitis.

PROLAPSE OF THE UTERUS OF UNUSUAL ORIGIN

By J. R. JUDD, M.D., F.A.C.S., Honolulu, Hawaii

A PROLAPSE of the uterus to the third degree in a young multipara caused by the presence of inflammatory tissue in the pelvis is sufficiently rare to be worth recording.

The patient was a Hawaiian girl, 21 years of age. Four years ago she had contracted gonorrhea. Two years ago she first noticed a protrusion at the vulva which was especially prominent on exertion. During menstruation she claimed that the protrusion receded somewhat. For the past year she had suffered a good deal of pelvic pain. Examination showed a prolapse of the uterus of the third degree. The cervix was not ulcerated. The uterus was fixed and could not be replaced, and the pelvis was filled with a large, tender mass.

At operation the pelvis was found to contain an inflammatory mass involving the uterus, adnexa, bladder and

rectum. With considerable difficulty the bladder was separated from the anterior wall of the uterus, a wound in the bladder acting as a guide. A small piece of ovarian tissue was identified and allowed to remain. The impossibility of being able to separate the structures successfully was recognized, so the mass was removed in one piece. It was then discovered that several inches of rectum incorporated in the mass had been removed with it. The continuity of the bowel was established by Gibson's tube method, which was easy of execution. It was noted that the cervix receded at once as soon as the inflammatory tumor was removed. The patient made a satisfactory recovery with drainage at the lower end of the wound.

Examination of the specimen showed the body of the uterus, tubes, ovarian tissue and a piece of rectum hopelessly involved in dense firm inflammatory tissue the whole constituting a tumor the size of an adult's head. There were several abscess cavities containing sterile pus.

A NEW OPERATION FOR COLON EXCLUSION

BY A. B. SMALL, M.D., DALLAS, TEXAS

SINCE Lane first enunciated his drainage scheme by means of colectomy, many modifications of his device have appeared in the literature. Objections have been registered against all the modifications as well as the original operation.

In a study of the subject while observing twenty-five cases operated, the first dating from January 3, 1912, for many reasons to be detailed in a later paper, the following operation seems most advantageous, namely, the resection of the terminal end of the ileum, the cæcum and ascending colon to be circumvented by anastomosing the ileum with the lower segment of the sigmoid.

The technique of the operation is briefly as follows:

Step 1. The ileocolic, the right colic, and a slender branch from the superior mesenteric anastomosing in the terminal six inches of the ileum with the ileocolic, are ligated. The structures which receive their supply from these blood vessels are then separated from their

attachments, "mobilized" and lifted out of the abdominal incision where the gut is clamped, and the resection completed with a negligible loss of blood.

Step 2. The raw base from which the structures have been removed is now covered by the parietomural flap, made fast by interrupted catgut sutures to the opposing mesoperitoneal margin.

Step 3. The operation is completed by doing an ileosigmoidostomy.

Advantages as seen in this technique are as follows:

1. In it the least amount of manipulation of the intestines is made, hence the least degree of shock to the patient.

2. It eradicates the fountain head of infection in 90 per cent of the extreme cases of intestinal stasis.

3. It displaces the ileum in the least degree from its normal position and downward so that gravity aids rather than retards its action.

4. The omentum is left undisturbed.

integrity may save the kidney or a ureteral anastomosis. In urethral fistula we know that any stenosis will cause perpetuation of the fistula. In such cases dilatation of the stenosis aids in closing the fistula, we believe it to be so in ureteral fistula, and we trust that in the report of these cases we may stimulate the members of this association to a trial of this

method, and the subsequent publication of their results.

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ACUTE TORSION OF THE RIGHT INTERABDOMINAL SPERMATIC CORD, THE SYMPTOMS OF WHICH SIMULATE ACUTE APPENDICITIS

By FREDERICK CLEGG, F.R.C., M.D., CHICAGO
 Surgeon to the University Hospital

I HAVE recently had occasion to witness an interesting case which presented the symptoms of acute appendicitis or torsion of the right interabdominal cord.

The patient, a strong and fit male, entered St. Anthony's Hospital at 8 a.m. November 1, 1911. He had had no previous abdominal symptoms. His present trouble began about 1 a.m. on November 1, 1911. He presented the classical syndrome of an acute abdominal crisis. Examination of the abdomen and the right testicle. It had never appeared to the surgeon that the right testicle was severely and markedly inflamed. A vomiting, rapid pulse, tenderness at the right right abdominal region, elevation of temperature, and a leucocyte count of 18,000. Differential white count was not completed.

The diagnosis of acute appendicitis or torsion of the right interabdominal spermatic cord was made at 8 a.m. the following day. The abdominal cavity was opened by retracting the fibers of the rectus muscle downward. The testicle was located midway between the umbilicus and the anterior superior spine of the ilium. The testicle and vas deferens being suspended by the spermatic cord. The spermatic cord was completely cut away by means of this had isolated the blood supply to the testicle. The structure of the spermatic cord that the process was a life and the testicle presented the appearance of gangrene. The cord and testicle were removed. The appendix was removed.

This condition should be considered in the diagnosis of acute appendicitis.

PROLAPSE OF THE UTERUS OF UNUSUAL ORIGIN

By J. F. HUBB, M.D., F.A.C.S., HONOLULU, HAWAII

A PROLAPSE of the uterus to the third degree in a young nullipara caused by the presence of inflammatory tissue in the pelvis is sufficiently rare to be worth recording.

The patient was a Hawaiian girl, 3 years of age. Four years ago she had contracted gonorrhea. Two years ago she first noticed a protrusion at the vulva which was especially prominent on exertion. During menstruation she claimed that the protrusion receded somewhat. For the past year she had suffered a good deal of pelvic pain. Examination showed a prolapse of the uterus of the third degree. The cervix was not ulcerated. The uterus was hard and could not be replaced, and the pelvis was filled with a large, tender mass.

At operation the pelvis was found to contain an inflammatory mass involving the uterus, adnexa, bladder and

rectum. With considerable difficulty the bladder was separated from the anterior wall of the uterus, a wound in the bladder being as a rule. A small piece of ovarian tissue was identified and allowed to remain. The rectum was being able to separate the structures carefully was recognized as the mass was removed. It was then discovered that several inches of rectum were contained in the mass, had been removed with it. The continuity of the bowel was established by a double-barrel method, which was easy of execution. It was noted that the cervix exerted at once as much as the inflammatory tissue was removed. The patient made a satisfactory recovery with drainage at the lower end of the wound.

Examination of the specimen showed the body of the uterus, tubes, ovarian tissue, and part of rectum hopelessly involved in the same inflammatory mass, the whole constituting a tumor of the size of an adult head. There were several abscess cavities containing sterile pus.

January, 1912, with a history of one year's standing. He first noticed a tickling sensation in the calf of the right leg gradually extending upward. This persisted for ten months when he noticed while taking a bath that the upper part of his body was more sensitive than the lower. Nine months before, the right knee became stiff and he had difficulty in walking. Four months ago the left leg became similarly affected. Since that time he has grown gradually worse up to the time of admission. At this time there was a marked spastic paraplegia of the lower extremities with sensory symptoms of all three sensations to the level of the tenth dorsal segment. Wassermann and X ray were negative. The patient refused operation and left the hospital.

He returned on the first of July in a much worse condition. He was bedridden. There was complete paralysis of the lower extremities with marked bladder and rectal disturbances. The physical examination showed spastic paraplegia of both lower extremities with exaggerated reflexes, ankle clonus, Babinski and Oppenheim. Sensory symptoms consisted of a diminution of all three sensations up to the tenth dorsal level on the right side and a total loss of feeling to same level on the left.

Laminectomy was performed on July 5, 1912, the spines and laminae of the five lower dorsal vertebrae being removed. Nothing was found to explain the symptoms. The patient went home after two weeks, unrelieved.

He was next seen at Montefiore Home in January, 1914. At this time there were symptoms, both sensory and motor, up to the level of the second dorsal segment with no sensory disturbance in the upper extremities, therefore this part of the cord was exposed by laminectomy on January 6, the seventh and eighth cervical and first and second dorsal spines being removed. Nothing was found over the region of the spinal cord exposed. A probe passed upward, however, met with a resistance at the level of the sixth cervical, therefore three more spines and laminae were removed in an upward direction and at the upper area of the cord exposed far above where the symptoms had indicated, a small extramedullary tumor was found and easily removed. Convalescence and operation were uncomplicated. Improvement started at once, and at the present time the patient is practically well able to walk long distances without trouble, and all of the motor and sensory symptoms have disappeared.

The interest in this case lay in the shifting of the level symptoms. In July, 1912, the symptoms pointed clearly to the tenth dorsal segment, in January 1914 the symptoms pointed to the second dorsal segment, but the tumor was found at the sixth cervical segment.

PUNCTURE OF CORPUS CALLOSUM FOR HYDROCEPHALUS

DR. ELSBERG presented a child of three years who had had a four months' history of rapidly advancing

hydrocephalus. During two weeks preceding the operation the child had become drowsy, an optic neuritis which had existed for three months became much aggravated so that sight was almost lost and the pupils no longer reacted to light. At the same time a spasticity of the lower extremities became so extreme that the limbs were stiff and could not be moved or bent at the joints. There was marked nystagmus and extreme enlargement of the head. The patient was seen by a number of neurologists and the diagnosis made was either idiopathic hydrocephalus or cerebellar tumor.

On February 16, 1915, Dr. Elsberg performed puncture of the corpus callosum—a large amount of fluid being evacuated from the ventricle. Improvement was immediate after the operation. Within twenty-four hours the pupils again responded to light, the spasticity in the lower extremities was much decreased, and the child was much brighter. From that time up to the present the improvement has steadily continued. At present, the mental condition is normal, the size of the head is greatly less, almost all the spasticity in the lower extremities has disappeared, and sight is practically normal. Before the operation, the swelling of the discs measured 6 diopter, at the last examination two days ago all swelling had disappeared and the eye grounds were practically normal.

The case demonstrates the great benefit that will follow puncture of the corpus callosum in some cases of hydrocephalus.

INTRAMEDULLARY SARCOMA OF THE CERVICAL CORD, EXPLORATORY OPERATION

DR. FOSTER KENNEDY presented from the Second Division the case of H. G., age 21, admitted to the hospital complaining of pain in the back of the neck and disability in the left upper extremity. At the onset in November, 1914, there was slight indefinitely located pain in the left shoulder which had been present for one week, then sudden loss of power in the left shoulder girdle muscles when in the act of hanging up his coat on a hook. He was seen two weeks later at the Cornell Neurological Clinic, where he was found to have profound weakness and atrophy in the left deltoid, biceps, and triceps with less marked weakness in all the forearm and intrinsic hand muscles of the left side. The triceps jerk was absent on the left side, the left supinator jerk was weak. The abdominal reflexes were absent the plantar reflexes, left flexor, right doubtful. Knee jerks left greater than right. Sensory examination then showed a marked loss of appreciation of superficial pain over the right side of the trunk below the level of the fifth cervical segment. This obtained also in the right lower extremity. Superficial pain as has been said was felt less well in affected areas, but at the same time there was produced by each stimulus a fairly widely diffused tingling sensation not experienced on the left side of the body. Similar loss to pain was found

TRANSACTIONS OF SOCIETIES

CLINICAL CONFERENCE OF THE NEW YORK NEUROLOGICAL INSTITUTE

REGULAR MEETING, MARCH 18, 1915, DR. J. RAMSAY HUNT IN THE CHAIR

CRANIOTOMY AND REMOVAL OF MULTIPLE BRAIN TUMORS

DR CHARLES A EISENBERG presented a patient who was admitted to the Third Division and operated upon in February, March, and April 1913. Twelve years before, the man was struck on the head by a falling timber, sustaining a scalp wound. In October, 1912, he began to complain of severe pain in the back of the head, which gradually became worse and was most severe at night. Two weeks before admission the pain became so severe that the patient threatened to commit suicide. One year before he noticed a lump on his head at the site of the old injury. The examination showed on the posterior part of the right parietal horn near the median line a swelling about two inches in diameter, slightly tender on pressure. Over the greatest prominence of the swelling was a small scar one inch long. The cranial nerves were normal except the second. Dr Holden reported that the margins of the discs were blurred and there was swelling of one dropper in each eye. Vision 20/30. The right wrist jerk was slightly stronger than the left, and the grip of the right hand slightly weaker than the left. The knee jerks and ankle jerks were exaggerated on the left side. There was a marked disorientation, when the patient walked outside of his room he was unable to find his way back to his room. This was not due to defective vision but to the fact, as the patient expressed it that he had lost his way and didn't know his way back to his room.

On February 23, 1913, Dr Eisenberg operated. A large flap of scalp was turned down over the region of the swelling which consisted of soft vascular bone, a large amount of it, measuring 4 x 6 cm, was removed and the dura exposed. The dura was much thickened and bled as soon as it was touched. The scalp flap was returned to its place. Further manipulations were deferred because the patient had lost much blood from the vascular bone.

Ten days later the wound was reopened and the dura incised. The dura was in parts at least 2 cm thick and the bleeding from it very free. When the dural edges were retracted the cortex appeared normal. Palpation at once revealed two large hard masses underneath the cortex one near the median line, the other low down in the parietal region.

The cortex was incised over each mass, and two tumors, each measuring 4 x 5 cm in diameter, easily shelled out of the brain tissue. When the dura was examined it was found that it was much thickened in all directions. The examining finger could feel the falx cerebri at least one inch thick and very irregular. The thickening of the dura extended backward to the tentorium and downward to the temporal lobe. As the patient's condition was poor, nothing further was done, the dura was left wide open and the skin wound closed in the usual manner. Convalescence from the operation was uneventful. Within one week the eye grounds were normal, the patient had lost his headache completely, and the disorientation was gone. He was out of bed within ten days—apparently well. Three weeks later the wound was again opened and an attempt was made to remove the diseased dura. This could only be partially done, as the falx cerebri could not be removed in spite of ligation of the longitudinal sinus. The patient recovered from the operation and remained well for two years.

The pathologist reported the tumors and the dura to be endothelioma, the affected bone was a rarifying osteitis.

The interesting features about this case were the presence of two large tumors without localizing signs, the remarkable disorientation, the fact that the patient remained well in spite of the fact that the disease still remained, and finally the appearance of disease of the bone, dura, and brain at the exact location of the former injury.

The patient had been presented before the New York Surgical Society six months before. During the past four months his symptoms have begun to return. There is now considerable bulging at the site of the operation and the patient is very unsteady on his feet. He now has considerable head ache every day. It is evident that the disease, after a period of quiescence, has again advanced. At the present time the condition is a hopeless one.

EXTRAMEDULLARY SPINAL TUMOR WITH FALSE LOCALIZING SIGNS, COMPLETE RELIEF AFTER REMOVAL OF TUMOR

DR EISENBERG presented Harry R., age 24, who was admitted to the Neurological Institute in

weeks and massage and passive motion started. There was prompt improvement in the nutrition of the extremity, but of course insufficient time has elapsed for any regeneration to have occurred in the ulnar nerve.

April 9, 1915 A note from the father states that there has been remarkable improvement in the whole extremity, so that the prognosis seems to be favorable.

TRAUMATIC INTERSTITIAL NEURITIS OF THE RIGHT ULNAR NERVE, NEUROLYSIS FOLLOWED BY PROMPT AND CONTINUING IMPROVEMENT

DR ALFRED S. TAYLOR presented from the First Division a man 32 years old. In July 1914 the patient swooned from exhaustion just after contesting a competitive field athletic event. During the period of unconsciousness some unknown physician gave him an injection of strychnine (reported by friends), thrusting the needle into the inner aspect of the right upper arm at about its middle. After the return of consciousness the inner side of the right hand and forearm felt numb, and he found that the fine coordinated movements of the hand and fingers were lost to his control so that he could not write although he had previously been an expert penman. In addition to the loss of sensation and motion there soon developed an atrophy of the muscles of the ulnar side of the forearm and the muscles of the hand supplied by the ulnar nerve.

These symptoms steadily increased in severity up to the time he entered the Neurological Institute on March 8, 1915, some eight months after the traumatism. The ring and little fingers are the site of constant severe pain, which gets worse rather than better as time goes on.

Physical examination. General condition fair. The right forearm and hand show the typical deformity of ulnar paralysis. There is atrophy of the interossei, and some atrophy of the hypothenar eminence. The thenar seems normal. There is atrophy of the muscles of the ulnar side of the forearm. The power of flexion is practically absent in the little finger and very slightly present in the terminal phalanx of the ring finger. He cannot adduct the little finger but can very slightly abduct both it and the ring finger. The ulnar nerve does not respond to either electric current. The median and radial respond normally. All the muscles supplied by the ulnar nerve show no response to either current. All the other muscles respond normally.

Operation. March 8, 1915 under ether anesthesia. Incision was made over the course of the ulnar nerve in the middle third of the right upper arm, and the nerve was exposed for a length of 12 cm. The middle 4 cm. of this exposed nerve was nearly twice as thick as the nerve above and below, was somewhat fusiform in shape, and was of a dull reddish color. The outer sheath was much denser than normal and was distinctly adherent to all the surrounding

structures. It was entirely removed by careful dissection. By similar dissection the thickened sheaths of the bundles which go to make up the whole trunk of the ulnar nerve were removed, until the fibers were obviously no longer compressed by cicatricial tissue. The bundles were all placed together and then wrapped in Cargile membrane. The wound was closed by silk sutures. Healing was by primary union. Improvement in ulnar function began promptly after the operation and has continued rapidly up to this time, which is 10 days after operation. Sensation to pin prick has returned in the two fingers previously anæsthetic, and motion is returning in the flexor muscles.

LAMINECTOMY FOR DORSAL PACHYMENINGITIS

DR R. G. CANNADAY presented a patient from the service of Dr. Peterson who was operated on November 20, 1913. She was a young woman who at ten years of age had some spinal trouble, for which she was in bed for a number of weeks. She was well until three years before when she began to have pain in the upper part of the chest extending to the left shoulder. The pain persisted off and on until five weeks before operation, when it disappeared. Two months before, she began to stagger when walking and had a girdle sensation around the upper part of her body. Physical examination showed a marked spasticity of the lower extremities. Abdominal reflexes were absent. The right lower limb was weaker than the left, the right knee jerk and ankle jerk were much exaggerated, there was right patellar and double ankle clonus, double Babinski and marked diminution in deep muscle sense in both lower limbs. Tactile and pain sensation were slightly diminished below the fifth dorsal level. Thermal sensation was diminished to the knees, absent below this. By laminectomy Dr. Elsberg removed the arches of the fourth to seventh dorsal vertebrae. The dura was found much changed, at the fifth and sixth dorsal level it was swollen as if there was a tumor underneath but examination showed that the swelling was in the dura itself. When the dura was incised it was found almost 1 cm. thick over an area of 4 cm., very hard and firm and compressing the cord underneath. The thickened portion of the dura was excised and the wound closed in the usual manner. For some weeks after the operation the patient complained of marked root pains over the fifth and sixth dorsal. These soon disappeared. The spasticity gradually decreased. Within three months she was relieved of almost all of her symptoms and has remained well.

Pathological report was chronic inflammation.

EXTRADURAL SPINAL TUMOR PRESENTING UNUSUAL SYMPTOMS

DR ELSBERG presented a patient admitted to the service of Dr. Collins in October, 1913. His first symptoms were staggering and weakness of the lower limbs three months before. The weakness

on the inner side of both upper extremities, but pain stimuli on the left arm did not produce tingling as they did on the right arm. Loss of power to discriminate between temperatures was found in the areas affected by changes in pain sensibility. Occasional mistakes in position sense were made in the left toes, none in the right side. Touch sensation was everywhere sharply appreciated.

These findings led to the initial diagnosis of a hemorrhage into a syringal cavity. The extraordinary acuteness of the onset, together with the dissociation in sensibility, seemed to leave no room for doubt in the matter. The Wassermann test in the blood and cerebrospinal fluid was negative, but the latter showed a definite increase in globulin content. However, in the course of the next six weeks there occurred definitely progressive weakness in the forearm and intrinsic hand muscles of the left side. Pain in the neck became very severe and radiated into the left arm and occasionally into the right. X-ray examination was negative. This steady progression in symptoms caused a change to be made in the diagnosis, it becoming apparent that the fourth and fifth cervical segments were the seat of an expanding lesion, most probably neoplasm. The development of slight urinary incontinence strengthened this belief.

Exploratory laminectomy was performed by Dr. Ihsberg in the beginning of February. The last three cervical segments of the cord were seen to be swollen and a small incision in the posterior columns revealed the presence of a dark red mass occupying the center of the cord. Superiorly the mass was homogeneous and resembled blood clot; inferiorly it looked like formed tissue and a portion was removed with difficulty for microscopic examination. The results of the operation were an increase in the left upper extremity palsy and some spasticity in the left leg with however an almost complete cessation of pain in the neck. Catheterization was required for ten days after which the bladder function became normal. The growth was found to be a round celled sarcoma. In the past week there has developed a progressive weakness in the right hand muscles and pain in the neck shooting down the right arm similar to that which was formerly present on the left side.

Dr. Abbe has kindly consented to treat the case by the application of radium, no improvement being hoped for by further operative procedures.

AVULSION OF THE LOWER ROOTS OF THE LEFT BRACHIAL PLEXUS FIFTH CERVICAL AND FIRST DORSAL TRANSFERRED BY LATERAL ANASTOMOSIS INTO THE JUNCTION OF FIFTH AND SIXTH CERVICALS

DR. ALFRED S. TAYLOR presented Eleanor L. age 8, from the First Division of the Neurological Institute. When she was two years old an impatient nurse had jerked her upward suddenly by means of

the left arm. She complained of pain in the left shoulder and the family doctor put on an adhesive plaster dressing. After the adhesive dressing had been on for two weeks she was taken to another physician who found a subglenoid dislocation of the shoulder which he reduced. From the time of the injury there was marked loss of power in the extremity, which also failed to grow as it should.

Physical examination. The patient is a well developed, well nourished child, sound everywhere except in the left upper extremity, which is considerably under developed and shows the typical deformity of ulnar paralysis. There is paralysis and atrophy of the intrinsic muscles of the hand which derive their innervation from the ulnar nerve, as well as of the flexor and extensor carpi ulnaris. There is practically no power to flex the ring and little fingers, nor to abduct the hand. The intrinsic muscles of the hand supplied by the ulnar nerve show no response to either galvanic or faradic current. There was some difference of opinion as to the response of the flexor and extensor carpi ulnaris, but they were obviously atrophied. Out side of the ulnar distribution the muscles showed normal reactions, although the whole extremity was smaller and less well developed than that on the right side.

The left eyeball and the left palpebral fissure are very slightly smaller on the left than on the right side. The reflexes in the lower extremities are normal and equal on the two sides. The case is obviously one of traumatic ulnar paralysis and the question is whether the trauma occurred in the axilla opposite the head of the humerus which is said to have been dislocated or whether the lower two roots of the brachial plexus were damaged near the spinal cord. The conditions noted in the left eyeball and palpebral fissure would lead one to feel that the damage was close to or within the spinal canal.

Operation January 30, 1915, by Dr. A. S. Taylor, under ether anesthesia. The incision started near the clavicular insertion of the sternomastoid muscle and passed outward and slightly upward across the base of the neck. This incision was carried directly down to the plexus. All the roots and cords of the plexus appeared normal to sight and touch, there being no deformity and no adhesions about the nerves. The finger was passed beneath the clavicle and down into the axilla. There were no adhesions or other signs of traumatism in the axilla such as would have existed opposite the shoulder joint had its dislocation been the cause of the ulnar injury.

There was left then only the alternative that the two lowest roots of the plexus had been torn within the spinal canal. These roots eighth cervical and first dorsal, were divided and inserted into a longitudinal slit in the junction of the fifth and sixth cervical roots where they were fastened by fine catgut sutures. The wound was closed without drainage. Healing was by primary union.

The fixation dressings were removed after five

CHICAGO SURGICAL SOCIETY

REGULAR MEETING HELD MARCH 5, 1915, WITH THE PRESIDENT, DR. DANIEL N. EISENDRATH, IN THE CHAIR

DR. JACOB FRANK presented three cases, as follows:

FETIT-MAL DUE TO ADHESIONS BETWEEN DURA AND BRAIN

CASE 1 Mr R H, aged 22, in September, 1912, while engaged in an argument, was struck on the head with a clock. This occurred on Friday. The following Sunday he became unconscious, and remained at home in this condition three days. He was then transferred to the University Hospital, where he remained nine or ten days without improvement. His people were then told that immediate operation was necessary to save his life, whereupon he was brought to the Columbus Hospital. When I saw him he was unconscious and could be aroused only by deep pressure over the superior orbital nerves. An X-ray was taken, revealing a depression on the left side of the head.

The operation was done in the usual manner. The skull was raised, the dura opened, and clots and bloody fluid which had invaded the subdural space were removed. There was immediate improvement. His pulse became better and consciousness gradually returned. Unfortunately infection of a saprophytic nature took place. The dura was sewed with catgut, and during this infection some brain tissue was lost. A few spicula of bone were removed some six or eight weeks thereafter, but he left for home apparently in good condition about three months after the operation.

Four months later he had slight attacks of Jacksonian epilepsy or petit mal. He would have two or three attacks a week, the attacks gradually becoming worse. An X-ray of the head was taken, which unfortunately was lost, but the skiagram did not show any spicula of bone. I made up my mind that there must be some adhesion between the inner table of the cranial vault and the dura, or between the dura and brain, which was causing his attacks. He returned to the hospital and the site of the previous operation was explored. Where the dura had been incised there was a strong adhesion. All cicatricial tissue was carefully removed and the wound was closed in a different manner. The first time no drainage was used, and I think this was the cause of the suppuration. The tissues could not take care of the blood which poured out between the scalp and the bone. At the operation for removal of this cicatricial tissue there was a great deal of bleeding. Instead of sewing up primarily, I packed the wound with gauze and placed sutures temporarily. The next day I removed the gauze and brought the sutures taut, using a small piece of

gutta percha as a drain. This was on July 4, 1913, just nine months after the injury occurred. He remained in the hospital a short time, made a complete recovery, and has not had any attacks since. He has married, has a child, and conducts a small business for himself.

In these cases where I leave out the bone, the dressings are held in place with Russian felt, which conforms to the contour of the skull and counteracts intracranial pressure.

CEREBELLAR ABSCESS, SUBDURAL HÆMORRHAGE

CASE 2 Miss R K, aged 27. Twelve years ago while crossing the ocean she experienced a sudden pain in the right ear which lasted two days. There was no discharge from the ear at the time. Five years later she had an earache which was slightly relieved by paracentesis. She does not remember whether any pus discharged, but there was some bloody discharge. Six weeks later another puncture was made without relief. When I first saw her, she apparently was suffering tortures, complaining of dizziness, tinnitus aurium, and excruciating pain. I advised immediate operation. She was taken to the hospital, and soon after arriving lapsed into unconsciousness, this state being associated with right sided hemiplegia.

Thinking it was an ear case, her family wished to call in consultation Dr. Pierce. To this I readily consented.

The operation was performed the next day. Dr. Pierce searched carefully for pus in the mastoid region without success. It was then decided to attack the cerebellum. Dr. Pierce asked me to finish the procedure by opening the cerebellar fossa. A flap was turned down, and through a nick in the dura a blunt grooved director was introduced, whereupon foul-smelling pus began to flow. The opening was made larger, the dura was incised, and a forceps was pushed into the cavity, releasing a small cupful of pus. The cavity was explored digitally in every direction and through a counterpuncture in the scalp a large drainage tube was put in place. She remained unconscious two weeks, and then gradually began to improve. She had word blindness at first, but in five weeks she recovered completely.

SECONDARY OPERATION FOR REMOVAL OF GASSERIAN GANGLION

CASE 3 Mrs G, aged 30. Twelve years ago she was treated medically for four years for facial

soon became so marked that he often fell to the ground. He was examined in the out-patient department a number of times and the only signs that could be discovered were lively knee-jerks and ankle jerks and irregular areas of tactile anesthesia on the anterior surfaces of both thighs. Wassermann and X-ray were negative, and spinal fluid showed no increase of globulin. He was able to walk with difficulty until February, 1913. Then he became much worse, took to bed, and began to complain for the first time of a pain in the right side of the abdomen and pain in the back around the waistline when he tried to sit down. Physical examination showed that the left knee jerk and ankle jerk were exaggerated, the abdominal reflexes normal, exhaustible ankle clonus on the left side with Babinski and loss of deep muscle sense. He could not move the legs at all. Sensory examination showed a diminution of all three sensations up to the level of the twelfth dorsal segment.

Laminectomy was performed by Dr. Isberg on February 14, the spines and laminae of the ninth, tenth and eleventh dorsal vertebrae being removed. On the right side of the dura was found a soft bluish tumor about 3 cm. long and 1 cm. wide adherent to the outer surface of the dura. The tumor was removed without difficulty, one nerve root ran over it having to be divided. The wound was then closed in the usual manner. Within three weeks the patient had regained complete control of the lower extremities with return of normal sensation. The tumor was a fibroma with calcareous degeneration.

The interesting features of this case were the late appearance of the nerve root symptoms referable to the eleventh dorsal root and the very irregular sensory symptoms from the beginning.

LAMINECTOMY FOR REMOVAL OF SPINAL CORD TUMOR, AND SUBSEQUENT POSTERIOR ROOT SECTION FOR RELIEF OF SPASTICITY

Dr. R. G. Cannaday presented Mrs. S., age 50, who was admitted to the Third Division of the Hospital on May 30, 1914, with the following complaints: Pains in the back and lower extremities and inability to walk or stand, incontinence of urine, contraction of the hamstring muscles of both legs. The history was as follows: Nine months ago she had an attack of grippe and complained of pain and cold sensations all over her body. She got better of the grippe and about two weeks later she began to complain of a stiffness in the muscles of her thighs, with pain in her feet, ankles, knees, hips, and back. The pain in her back was located in the lower lumbar and upper dorsal regions. These symptoms progressed slowly, until about twelve weeks ago when she began to get rapidly worse. At this time she became very weak in the legs and found that she was unable either to walk or stand. Very soon afterward her hamstring muscles began to contract and flex her legs upon her thighs. Her ankles at this time began to swell. She was unable

to extend her legs voluntarily, and when they were forcibly extended she would cry out in pain. Her incontinence began about three months before her admission to this Hospital.

Physical examination. Cranial nerves normal, pupils round, and react normally to light and on accommodation, biceps jerks active and equal, triceps jerks active and equal, wrist jerks active and equal, abdominal and epigastric reflexes absent, knee jerks present and equal, ankle jerks present and equal, ankle clonus on both sides, plantar response was of the extensor type. Double Babinski. Special senses and viscera negative. Sensory examination showed a complete loss of pain, temperature and tactile sensation from the third dorsal segment downward. Analysis of the spinal fluid was negative, except for an increase of globulin, examinations of urine and blood, negative, Wassermann reaction of blood and spinal fluid, negative.

Operation on June 10, 1914. A laminectomy was performed by Dr. A. S. Taylor. The spines and laminae of the second, third, fourth, and fifth dorsal vertebrae were removed, as well as a tumor about one inch in length and three-quarters of an inch in thickness lying opposite the third and fourth dorsal outside of and adherent to the dura.

Examination on July 6, 1914. Abdominal and epigastric reflexes still absent. Knee jerks not obtained. Ankle jerks present and equal. Right ankle clonus. Double Babinski reflex.

Pain sense gradually dulls going downward beginning about the level of the seventh dorsal segment and is not as acute on the right as on the left. There is no place in which the perception of pain is lost, but seems to be delayed. Perception to cold had returned and was well defined. The patient readily responded to the stimulus in the part of body where the sensation to cold was at one time wholly lost. Response to stimulation with heat had returned, but was not as acute as the response to stimulation by cold. Tactile sensation is well appreciated all over body. There is a dulling on the legs but can feel when touched. The spastic condition still persists and patient's legs are flexed tightly on her thighs. Cannot extend her legs voluntarily and cries out in great pain when force is applied.

Examinations on August 18, September 7, and October 5 did not show any especial changes.

On December 2, 1914, another operation was done by Dr. Taylor. The left laminae of the third, fourth, and fifth lumbar and the first sacral were removed, and a posterior root section of the third and fifth lumbar and the first sacral was done on both sides. Before the operation an effort to straighten the patient's legs under ether was made. This, however, was impossible. She made an uneventful recovery from the operation and the spasticity began to improve almost immediately.

At present she can extend her legs and is able to walk with crutches. She has good control of sphincters of the bladder and bowel, but still complains of some pain in the knees.

CHICAGO GYNECOLOGICAL SOCIETY

REGULAR MEETING HELD MARCH 19, 1915, WITH DR. N. SPROAT HEANEY IN THE CHAIR

HÆMOLYSIS IN OBSTETRICAL CASES

DR. RUDOLPH W. HOLMES reported the following cases

The blood dyscrasias have received not an inconsiderable amount of study at the hands of hæmologists — but this has largely been restricted to medical, and to an extent, to surgical diseases. The paucity of contributions on hæmolysis in obstetrics warrants I believe, a brief report of the cases here presented, even though two of them were seen full ten years ago and one over a year ago.

Mrs. P., age 32, married, two living children, and one abortion three years before the onset of the disease to be narrated. Some three months previous to my seeing her, she was curetted for a profuse hæmorrhage — the fact of an early abortion not being determined. Her menstruations always have been regular from their onset at 14 years, painless, and of the three-day type. On August 12, 1904, the woman, feeling indisposed, took a dose of magnesium sulphate or at least she presumed this was the cathartic. Shortly thereafter she was seized with dizziness, had an attack of emesis and a pain in her back. Shortly after the development of the above symptoms she had an intense action of the bowels. In the early morning of the 13th she had an alarming uterine hæmorrhage at the time her normal period was due. On account of the actual hæmorrhage, Dr. J. V. Fowler was called, he tamponed the vagina, believing there was an early abortion. As there was severe prostration he called me to see the patient. He had to go to a neighboring telephone to call me and was away hardly a half hour, if that, much to his surprise, on his return, he found the skin of the patient deeply discolored. The color was of a bronzing rather than the icteroid bluing of a biliary disease. On my arrival probably within the hour after his return, the skin was most intensely discolored, the conjunctival sclera participating in the change, this coloration resembled more nearly that of Addison's disease. I removed the tampon, and examined the uterus was small, retroverted, perhaps somewhat softened. The liver was distinctly enlarged. The right kidney was easily palpable, enlarged, and freely movable. At no time was there any itching which so frequently accompanies a jaundice. By the second or third day the pigment had entirely disappeared, leaving the skin an alabaster whiteness. In the early morning Dr. Fowler found the temperature 104°, and pulse 120. A catheterized specimen of urine was obtained which was the color of the fluid extract of ergot, no blood cells were found in the specimen — a true hæmoglobinuria.

She was admitted to the St. Mary's Hospital with a temperature of 102.8° and a pulse of 140. On the 14th she passed a couple of stools which were clay colored. Her blood count showed whites 58,000, reds 3,200,000, on the 15th the whites were 36,800. Her stomach contents contained free hydrochloric acid, blood, fat-cells, and much mucus. In the next days the vomitus was frequently admixed with blood. The stools, which at first were clay colored, became dark brown, and at times green, with much mucoid fluid, at times the clay color recurred. After the 15th the temperature dropped to normal or 99° and so continued to the end, with the return of normal temperature her pulse fell to 80 or thereabouts, rising on the 27th to 140 or more. During these days her history was that of repeated small hæmorrhages from the stomach. There was a more or less constant bloody discharge from the vagina. Pneumococci were found in such profusion in the blood that it was needless to make cultures a smear was sufficient. The cause of death from clinical findings was acute pneumococcal infection, a true bacteræmia, hepatitis, nephritis, colitis. A post mortem was refused.

The second case was seen in the Cook County Hospital in the service of Dr. R. B. Preble, who was good enough to ask me to see the patient as he had seen the first patient with Dr. Fowler and me. Unfortunately, the definite history of this patient is not at hand. This woman, though she had a self induced abortion, was admitted by error to the medical service. As the intern was taking the patient's history he was much surprised to find the skin changing color, so that in a short time possibly a half hour, the woman's complexion which was light had changed to a deep bronze. The urine had the characteristics of a hæmoglobinuria, a blood smear showed fragmentary cellular elements, as in the other case but with streptococci in pure culture. She died some twelve hours after her admission to the hospital. Some 30 hours post mortem, Dr. Hunter, coroner's physician made an examination. The body was enormously distended having more the appearance of a "floater" in hot weather than a recently dead body. The extremities, as well as the cavities were filled with gas. All the structures, practically had so far advanced in decomposition that their identity could hardly be determined, the leg muscles were a thin grumous fluid. The uterus retained its consistency more than any other organ — it was possible to determine the fact that the cavity contained considerable decidual debris.

The third patient was 30 years of age, who two years before had had a difficult instrumental delivery the puerperium was complicated with a

neuralgia, without relief. Eight years ago an operation, the nature of which she does not know, was performed on her gums, affording her relief for three months. This operation was then repeated and in addition something was done to the inferior orbital nerve which relieved the pain again for two months, after which it returned and was severer than ever. Seven and one half years ago she was operated on by a Chicago surgeon and on recovering from the anæsthetic she could not open her eyelids. The eye itself was motionless, although the eyesight remained good. Ptosis remained two months. Partial control of the eye returned, but she could not close the lids entirely. After that the eye became red and painful and began to shrink. She was treated by this surgeon for five months, without relief, and was then transferred to an eye specialist, who continued treatment for one month, then the eye was enucleated. Following this she was well and without pain for two years. Again the pain returned, severer than ever. An other surgeon operated through the orbit, but the nature of the operation I do not know. This afforded relief for eight months, at the end of which time the pain returned as usual.

She came under my care in 1913. She was the most dilapidated individual I have ever seen. She could not open her mouth to talk or eat. A satisfactory history was not obtainable, but I made up my mind to go in at the location of the old scar. A large opening was made beyond this, the bone turned down, and all the zygoma removed to give plenty of space. The dissection was difficult on account of adhesions from the former operation. After the skull was opened I found that the surgeon who had previously operated on her had put in gutta percha tissue to prevent the reunion of the nerves. Everything was clearly in view. The brain and the dura were raised with the handle of a soup spoon, and in dissecting off the cicatrix the dura was incised so that one could see the brain in some places. With a hook I could lift up a few fibers of the ophthalmic nerve that had not been separated. The second and third divisions of the fifth nerve looked as though they were intact. If these were divided previously the gutta percha tissue did not keep the ends separated, but they had reunited. Thinking that the same thing might happen if the gas-trian ganglion merely were divided I pulled on the different divisions until they were loosened thoroughly, and cut them close to their attachments to the dura. In addition, all filaments of these branches going to the dura were dissected with scalpel and tissue forceps and cut away. The bone was not replaced. She began to improve and has continued well.

DISCUSSION

DR. NORVAL H. PIERCE. When I saw this patient she was suffering intense pain in the head. She had right facial paralysis, nausea, vomiting and

dizziness. A diagnosis of cerebellar abscess was made by the symptoms of intracranial pressure and by the presence of incoordination and attacks of vertigo in connection with a suppurating ear. She had spontaneous labyrinthine nystagmus, that is, nystagmus in which the movements could be well defined as of two components, quick and slow. The quick component was toward the diseased ear, and the slow component was toward the opposite side. Such nystagmus can originate only in the labyrinth or in the nervous mechanism back of the labyrinth. That it did not originate in the labyrinth was proved by the fact that the labyrinth was dead; it did not react either to sound or caloric influences. If we irrigate cold water into the external auditory canal we produce a nystagmus toward the opposite ear, that is to say, cold depresses the action of one labyrinth, so that normal action of the opposite labyrinth overweighs the depressed labyrinth. For example, if we irrigate a normal right ear with cold water, we produce a nystagmus with a slow component toward the right and a quick component toward the left. If we irrigate with hot water, we have the opposite effect. We stimulate the ear that is being irrigated. We proved in this case that the labyrinth was dead and yet the nystagmus to the right continued. A curious thing was that in turning experiments she apparently gave a reaction to the right ear. She had had a suppuration in that ear for some time. The history of these cases shows that they may have a slight discharge from the ear which is not sufficient to attract attention, and this discharge may go on for years, as it probably had in this case. The reaction we got in turning from right to left, was not due to stimulation of the right labyrinth in fact, but was a so-called compensation reaction, or a reaction that takes place from the opposite side after a labyrinth has been destroyed for a long time, that is to say, in case the right labyrinth has been destroyed and the left labyrinth is active if we turn the patient from right to left (counterclockwise) we get a reaction normally if we turn the patient rapidly ten times we get an after nystagmus lasting for thirty seconds. In case a labyrinth is destroyed we get nystagmus that will last for only ten seconds or less. This is due to compensation or overaction of the opposite or normal labyrinth.

This young woman still has a spontaneous nystagmus which comes out more obviously when we cause her eyes to turn in the direction of the quick component. It is very beautifully brought out in this case the quick component being toward the right side. This nystagmus cannot come from the labyrinth because it is destroyed. It must come from irritation of the scar in the cerebellum or from some inflammatory action. It has been quite a number of years since she was operated on—I think six years—so that probably it is not due to inflammation.

Abscess of the cerebellum comes on most frequently from labyrinthine suppuration, as does meningitis in the posterior fossa.

uterus to remove them manually. When the tampon is removed slowly, later, the separated membranes will come away with the gauze.

A CASE OF PLASMACYTOMA

DR EMIL RIES demonstrated three sections from a case of plasmacytoma of the ovary.

CARCINOMATOUS RIGHT INTERNAL ILIAC GLAND

DR EMIL RIES also demonstrated a microscopic section of a carcinomatous right internal iliac gland removed in a case of carcinoma of the uterus.

TORSION OF CORD PRODUCING FETAL DEATH

DR N. SPROAT HEANEY. I have here a placenta I want to exhibit because of its rarity. The possibility of the condition is not at all hard to understand, but it is the only case I have seen where, in advanced pregnancy, torsion of the cord produced fetal death. The patient is forty years of age, pregnant for the first time, after six years of marriage. The pregnancy was normal. On a Friday she felt a violent commotion of the fetus, and then all motion subsided. The following Monday I could not hear the fetal heart tones, but was not prepared to say that the fetus was dead. On Wednesday she gave birth to a macerated fetus. There is nothing in the history to suspect any systemic cause for the fetal death. The placenta shows no signs of syphilis. The placenta was born with the cord markedly twisted as you now see it. The strongest twist is at about the middle of the cord, while both the fetal and the maternal sides are oedematous. Through preservation the oedema was greatly decreased. However you can see the large number of twists of the cord. As soon as the child was cut loose the fetal end was tied to the maternal end of the cord so as to preserve the twists. The baby weighed six pounds two ounces and was within two weeks of expected date of birth.

DISCUSSION

DR HOLMES. I would like to ask Dr Heaney what he thinks caused the twist?

DR HEANEY. When I saw the patient some six or eight weeks before, the fetus lay transversely with the head to the right. The next time I saw her the parts were turned about, the head on the opposite side, with slight hydramnios.

DR PHILIP S. DOANE. Did you notice the position of the child from the time you saw the woman?

DR HEANEY. Yes, it was transverse when I saw her before delivery. I interpret the oedema on both sides of the extreme constriction as indicating there was torsion before the death of the fetus, and that a partially obstructed circulation is what caused the oedema.

DR LYNCH. When did you see her?

DR HEANEY. I saw her ten days before labor at the hospital when the fetus was active. Two days

before delivery I saw her in the office, but could not definitely say that the fetus was dead, the maternal pulse was elevated, and I had a cold. The presentation was longitudinal at labor, whereas before that it was transverse.

DR CHARLES E. PADDOCK. I believe there are more fatal cases from this cause than we know anything about. This case is rather unique in that the twist or constriction of the blood vessels is in the center of the cord, whereas, as a general rule, it is either near the umbilicus or placenta, death being caused in that way. There is no doubt but that this twist came on gradually, and then suddenly there was a shutting off of the circulation due to oedema, followed by sudden death of the fetus. There is a general active movement in these cases at first, and then death. In making a diagnosis of death of the child *in utero* we find there are sudden active fetal movements, and then a cessation of them. But this case is unusual from the fact that the constriction is in the center of the cord instead of at one end.

DR FRANK W. LYNCH. I think we are looking at a rare specimen. I do not think we very often encounter a cord which is sufficiently tight to cause the death of the fetus. Dr Watkins just remarked to me how difficult it is sometimes to tie a cord or constrict a vessel so that it will not bleed. We are able to prove by our microscopic studies that thickness of the cord compresses the circulation.

OBSERVATIONS ON THE OPERATIVE TREATMENT OF SALPINGITIS

DR MARK T. GOLDSTINE read a paper entitled "Observations on the Operative Treatment of Salpingitis" (See p. 239).

DISCUSSION

DR THOMAS J. WATKINS. This paper covers so much ground that it is rather difficult to know just what to discuss. I approve of most that the doctor has said. What he said, however, in regard to the ovary possibly might be discussed. He did not pay much attention to the internal secretion of the ovary. It would seem that the chief reason for leaving the ovaries or ovary if the tubes are removed is because of the internal secretion. Relative to the question of preserving menstruation where the tubes have to be removed. I believe none of us think now that menstruation is of any benefit to a woman aside from the possible mental effect of it, except it may delay senile changes of the vulva and vagina.

I believe it is pretty generally considered that tuberculous cases are better left alone, that if one finds tuberculosis, it is better to close up than to do any operative work. It is the experience of most operators that they operated on more tubercular cases in their early operative experience than they do now.

sharp gall-stone colic. January, 1914, she had an easy labor, during which for a brief period an obstetric anaesthesia of chloroform was given. For a week previous to her confinement she had an irregular temperature curve, reaching over 102° at least once. During this week she made repeated denial as to pain or tenderness in the hepatic area, though during labor she stated that she had made this denial simply to relieve anxiety on the part of the family, she then admitted she had at times experienced considerable distress directly referable to the gall bladder. As there was a considerable portion of membrane left, I lightly packed the uterus with gauze, though at this time there was merely the physiologic blood loss. She was returned to bed at 11:30 a. m. About an hour later there was a considerable blood spot on the sheet, though the uterus was contracted. Ergot was given, and morphine gr. $\frac{1}{6}$. At 2:15 p. m. there was a rather more severe bleeding but not an excessive one, and again the uterus was contracted. In spite of the contracted uterus there was a persistence of the bleeding so I re-packed tightly. There had been a slight nick in the perineum which had one silk worm suture for its repair. After the second tamponade the blood from above not escaping it was seen that this hardly more than abrasion was oozing persistently. The blood was not the characteristic red, but more the appearance of a watery port wine. The skin of the patient had not the appearance of exsanguination but more the bluish brown of the first patient as the discoloration was disappearing. In spite of horse serum calcium salts and stimulants, the patient succumbed at 3:30 p. m. The writer believes that the infective process during the last days of pregnancy emanating from the biliary tract, was the responsible cause for the failure of coagulation, as events came so quickly it was impossible to obtain specimens of blood and urine for examination but he believes that the peculiar discoloration of the skin if the process had not been so fulminating would have developed into the same type of hæmolytic as the first two.

DISCUSSION

DR. MARK T. GOLDSMINE. These case reports corroborate what we have done along the line of hæmophilia and hæmorrhage. According to Professor Howell, of Harvard, there is nothing in the blood itself, nor any explanation to be offered on that ground, that would cause these hæmorrhages. They must be due to infection. The only circumstance where we would have a hæmorrhage due to an auto hæmolytic in the blood would be in cases of hæmoglobinuria. However, one man has proved in a series of cases that there can be hæmorrhages from the kidney caused by the formation of auto hæmolytic in the blood.

DR. THOMAS J. WATKINS. As regards coagulation, from what I know of the subject from personal experience and otherwise, I am convinced that

the present methods of testing the time of coagulation of the blood are so uncertain that they are of little or no value. For example, in one girl, who was very much exsanguinated from hæmorrhage of the uterus, due to hæmophilia, the time of coagulation was less than normal. This was a typical case as she had had hæmorrhages from various parts of the body from childhood.

As a uterine pack for hæmorrhages in such cases our experience with iron gauze has been very satisfactory, as it is a good styptic and can be left for a long time without becoming offensive. Such a pack can be left in the uterus for one week without producing much disturbance.

I presume we all agree that human is better than other blood for injection in such cases.

DR. CHARLES E. PADDOCK. In regard to testing the coagulability of the blood, some one told me a few days ago that he had been experimenting with wire loops, that is, getting one or two drops of blood in a loop, using say half a dozen loops and by agitation in a certain amount of water and leaving it for a considerable time, then wiping it off it was found that the blood would usually coagulate very accurately. This is a simple method. It only takes four or five minutes to make the test. I do not know whether there is any one here who is prepared to discuss that method or not. I simply mention it for what it is worth.

DR. N. SPROAT HENNEY. Last May I visited Baltimore, and being interested in a particular phase of blood work I saw Professor Howell, the physiologist who has done so much work on the coagulability of the blood. From him I learned this: When you remove blood to test its coagulability it must be done by venous puncture. If you cut through tissue and squeeze the tissues, the blood will coagulate more quickly than when it flows freely, because the tissue itself has juices which increase the coagulability of blood. All blood should be removed first by venous puncture whatever the method of testing employed.

DR. RUDOLPH W. HOLMES. In my report of these three cases I did not say anything about hæmophilia acquired or congenital but merely dealt with the question of hæmolytic of infective origin nevertheless various men have asked me why I did not test the coagulability of the blood as a routine. For a surgical case it is one thing as you can set an hour for operation—the evening before would be too soon but shortly before operation you can test the coagulability of the blood—but to go every day and every few hours to see a pregnant patient with a view to testing the coagulability of the blood would be out of question. We know it varies from time to time during the day, depending upon what a patient has eaten and drunk, it varies also with exercise.

The tampon is not used on account of hæmorrhage primarily but to remove a considerable portion of membrane left in utero, it is better to tampon for retained membranes than to go in the

went to Europe. The physician who took charge of the case for me said she was confined with a living child. The ovary was the seat of an enormous abscess, and ruptured after childbirth, with fatal peritonitis.

We see these cases quite often where there is puerperal infection previous to the secondary flaring up with a subsequent pregnancy, and for that reason I think it is our duty to practice radical surgery or not to allow pregnancy to take place, as shown in this sad case.

With reference to tuberculosis, we have two things to consider: one, tubercular toxæmia, and the other a local tuberculosis. Just a few weeks ago I saw a woman near the climacteric with an enormous metrorrhagia. I opened her up and found a local tuberculosis. I removed the uterus. Another case I had was a case of enormous metrorrhagia and menorrhagia where I did not find any local tuberculosis but a general toxæmia. I removed the uterus with a myoma. Both of these patients picked up and gained in weight. That is my experience as far as tuberculosis is concerned.

DR HENRY F LEWIS: There is one point that has not yet been mentioned in the discussion, and that is the question of dealing with cystic ovaries. The essayist seemed to me to be unduly concerned as to the danger of leaving cystic ovaries on account of the trouble they make afterward. Perhaps I have not been as much afraid of them as I should have been. In my early operative work I removed a great many ovaries, later I resected them, and now I leave a great many alone that are not in very bad condition.

Another point is with reference to drainage. I see very few cases today in which I think it is necessary to drain. I used to drain nearly all of them. I drained when I was in doubt, later, when I was not in doubt I did not drain, and now there are very few cases I drain at all, regardless of the condition. Perhaps the cases where we need to drain are the acute puerperal cases, but these should seldom be operated on at all.

DR WILLIAM M THOMPSON: Regarding the methods of treatment of salpingitis, I recall a peculiar case of double pyosalpinx following pregnancy. The woman had gone through her pregnancy and developed pyosalpinx, as some of these cases do who have vaginal and cervical infection during the parturient period. In speaking of the case to the late Dr Scnn, he asked me what I did, and I told him I packed her in ice and let her alone, and she got apparently well. I think it is a fact that many of these cases, if we had a little more patience with them, put them to bed, gave them proper rest, and practically let them alone for a long enough time or until the whole process subsides, we could watch the tumor gradually disappear. We are then in a much safer condition to attack the disease when the patient has had a good long rest than when the temperature has just subsided.

As to the question of hysterectomy, the late Byron

Robinson made a suggestive remark before a meeting of the Chicago Medical Society a year or two previous to his death. The subject of pyosalpinx was under discussion, and Byron Robinson arose and dramatically said, "Double pyosalpinx, hysterectomy," and sat down. That was an extreme view at that time, and yet in a woman approaching the menopause I feel it is a proper procedure.

As to the advisability of leaving the uterus after one of these very damaging double pyosalpinx infections, I have a case in the hospital that I operated upon yesterday in which the question of ileus is hanging over me like the sword of Damocles. This woman had been operated on by a skillful operator. Both tubes were removed with the appendix, and the results were serious adhesions, symptoms of obstruction, and a nasty discharge. The end-results have not been mentioned in this discussion so far. In these very serious cases ileus does follow. We speak of peeling out the entire tube from the pelvis and covering up the raw surface or surfaces. You cannot cover up these raw surfaces in the cul-de-sac unless you take the peritoneum, after removing part of the uterus and strip it off from the bladder and broad ligaments and stitch it clear back across the rectum and thus cover up the pelvis, in other words, make the pelvis extraperitoneal. When this raw surface is left, following the peeling out of adherent tubes, the lower end of the ileum drops into the cul-de-sac and becomes adherent as it did in the case of which I have just spoken. And so today, after listening to these discussions, the subject of ileus is uppermost in my mind as a post-operative result of pyosalpinx.

DR FRANK W LYNCH: The remarks of the last speaker (Dr Thompson) deserve reinforcement. It seems to me, we should be guided in our operation by the chances of subsequent adhesions.

No one has mentioned the procedure of sewing the peritoneum from the bladder to the sigmoid colon as a routine whenever we leave a raw surface. Our results from operating for secondary adhesions are not encouraging. I think one of the strong points the essayist made in his paper was that he leaves intestinal adhesions alone unless there is a chance for obstruction. It seems to me, we should be guided in our treatment of the uterus by the question of the amount of pelvic covering unless there is visceroposis and a very relaxed abdominal wall. A uterus that is sticking up under the peritoneum, so to speak, with a raw surface to catch the gut, is not a uterus of much use to the ordinary person.

My preference for drainage is very much like that of Dr Lewis — when in doubt, drain — and I think he has very forcibly emphasized the value of this in the selection of cases. Certainly, all cases of salpingitis should not be operated upon.

DR PHILIP S DOANE: I would like to ask Dr Goldstone if he has a routine post-operative treatment for these cases.

I think one of the reasons why we are not drain-

As to the question of intestinal adhesions I am impressed with the fact that it is often better to excise the tube from the uterus and broad ligament before separating the intestinal adhesions. It facilitates the operation and diminishes the danger of injury to the intestine.

Another point which I believe is very valuable is the one of separating adhesions between the inflammatory mass and intestine, which consists in simply squeezing the parts between the fingers instead of separating them especially where the adhesion is a rather thick one. By squeezing the tissue you can separate the tube without any danger of injuring the bowel.

As to the question of drainage. It would seem to me that the operative technique and time of operation have developed to a point where one thinks it is very seldom necessary to drain. We practically never drain. Drainage then is used not as a life-saving measure but to minimize post-operative complications. It very often requires a great deal of judgment to know when one should remove the uterus where the tubes are removed. We probably all of us, make mistakes as regards removal of the uterus in such cases. It is nearly always possible and advisable to leave some ovarian structure.

DR CHANNING W. BARRETT. This paper brings up a number of interesting points most of which are settled in the mind of each operator. I have not come to a definite conclusion that will fit all cases, as the essayist seems to have arrived at. For instance, I see cases in which marked intestinal adhesions will require breaking up. I see cases in which it is necessary to take out some portion of the bowel, as little as we like to introduce the element of intestinal surgery in the case. I see cases in which the tubes have excavated under the sigmoid. I see cases in which it seems entirely permissible to remove one tube and leave the other. I have known such a patient to become pregnant afterward. I have known some to have extra uterine pregnancy afterward. I see cases in which it seems entirely permissible to take out one tube and leave the ovary on that side or take out both tubes, and leave both ovaries. We can leave one ovary and one tube on one side but if the other ovary and tube are matted together they have to be removed.

The point Dr Goldstone makes with reference to the preparation of the patient is important. The patients who come to the Cook County Hospital do not do so because of moderate disability. They come usually when they are able to do nothing further for themselves when their condition ceases to be a chronic affair if it ever got to be such and they come because there is a lighting up of their trouble with the temperature ranging from 103° to 104° with some evidence of a local or general peritoneal infection, and rather acute masses present. We have been inclined to put these patients on rest treatment and let the acute symptoms subside and we are not usually able to let them leave until the

temperature has reached normal for eight days because these patients nearly always go home early if we let them, and come back in a worse condition, so that we have tried to strike a happy medium of waiting until the temperature has reached normal for a few days, then, a little before they become anxious to go home, we subject them to operation and then the procedures that have been mentioned are carried out.

As to drainage, sometimes we want to drain because there is too much acuteness to leave out drainage. We sometimes drain because a large oozing surface that is present would furnish quite a little blood and sometimes we have to drain because weak places are left in the bowel, because the bowel is not in a condition to cover the weak places. I used to drain nearly all cases through the vagina, as the doctor indicated opening through the vagina by operation through the posterior cul-de-sac and getting in one end of the drain. Of late years I have been more inclined to drain through a stab-wound at the side of the original incision, and we can almost gain a point by getting primary union in the median incision by drainage at the side. We get seemingly better drainage than through the posterior cul-de-sac as there is not so much disturbance afterward.

The question as to what we are to do with the uterus is to be determined always by the condition in the uterus, not what we have done with the tubes and ovaries but what needs to be done with the uterus itself. It often becomes necessary to amputate above the cervix and leave a pretty good uterus as well as to leave an ovary to keep up menstruation. I may say here that menstruation has no effect, except a psychological one, upon the patient and that effect is very important to the patient herself.

DR THEODORE J. DOEDERLEIN. There is one point which has not been emphasized sufficiently, and that is the virulence of the poison of puerperal infection.

I recall a sad occurrence in my career of a case in which I considered three points. First, a very virulent poison may be left in the adnexa for years and retain its virulence, second as to the advisability of conservative surgery, and third whether we should permit future pregnancy.

That a virulent poison may remain in the adnexa for years is demonstrated by a case of puerperal infection on which I operated. The patient had become emaciated to a skeleton and a year after puerperal infection had taken place I operated on her. Then she was a young woman having had no child and as she desired to have a child I left one ovary and removed everything else, that is, the other side, and adhesions. The ovary seemed apparently normal. After the operation the woman picked up gained fifty pounds and got to be a very healthy woman. After a year she went to California became pregnant and wrote me that she was pregnant. I was taken sick at this time and

BOOK REVIEWS

A CRITIQUE OF NEW BOOKS IN SURGERY

By MAJOR G. SEELIG, St. Louis

THE present is distinctly an era of efficiency. Ever since Mr. Taylor popularized the idea we have had what practically amounts to an efficiency cult. Brick masons must handle the trowel and mortar just so, ladlers and puddlers, cutters and sewers, fitters and joiners must flex and extend only so often if they hope to turn out the largest amount of product in the smallest allotment of time. The strange fact is that the doctrine of effectiveness has been studied only in its relations to the various industries. Efficiency of act has completely overshadowed efficiency of thought. Of course, this is not so very strange, after all, for action is always tangible, measurable, and concrete, whereas thought is intangible, immeasurable, and elusive. Then, too, most of us associate action with technique, completely forgetting that there also is such a possibility as a technique of thinking. Take book reviewing as an example. The product of the reviewer is worthy or unworthy directly in proportion to the excellence of the technique of thought processes leading up to the final judgments expressed.

All this is apropos the fact that I have been trying to analyze my own technique of book reviewing incidentally to determine why it is so easy to formulate judgments some months and so insufferably difficult at other times. I think the problem stands solved. The books are read in turn, as they come from the publishers. Each volume is allowed full play in its effect on judgment, and each makes its appeal from a different angle. Invariably, however, among the group of books for the month, there is one volume that makes a broader appeal than do the others and in so doing vitalizes criticism. This volume, whichever one it happens to be, serves as a sort of catalyzer performing its function of fusing and solidifying critical thought without in any way losing its own identity in the process. When, among the volumes of the month, there is no catalyzer, reviewing is difficult, for then thoughts lag or at best hang together loosely.

And that is exactly what has happened this month. This first volume¹ for example appears so shortly after the publication of a similar volume by Bernheim (reviewed a few months ago in these columns) and the material is so nearly identical with that presented by Bernheim as to take the heart out of constructive criticism. Horsley brings to his task

the same essential and excellent qualification that characterized Bernheim's book, namely, a familiarity based on personal investigative work of a high order. Concerning this very qualification, one notes with gratification that, although Horsley details, *in extenso*, his own well worked out methods of arterial suture, he nevertheless, with excellent judgment, presents all the other important methods.

In this instance, just as in the case of Bernheim's book, we question very seriously the advisability of including too much in the monograph. Of course, varicose veins, varicocele, and hemorrhoids do group themselves under the head of Surgery of the Blood Vessels, nevertheless the inclusion of such topics tends to rob the little treatise of some of its essential monographic value, and surely there can be no question that Horsley drives too far afield when he describes and pictures the technique of intestinal anastomosis in a work devoted to blood vessel surgery.

By a strange irony of fate, all of Horsley's descriptive text bearing on transfusion has been rendered naught by the recent discovery of citrated blood transfusion. This new method, carefully worked out by Lewisohn and Weil, will undoubtedly displace all the other much more technical methods of transfusion. In similar manner, the recently published experiments of Stetten seem to settle very definitely the question of the value of reversal of circulation. One judges that Horsley will readily accept the conclusions of Stetten regarding the folly of reversal, for on page 81 he says, "the practical utility of reversal of the circulation is very doubtful."

One should never lay aside a good monograph without a certain sense of gratitude to both author and publisher for their respective parts in cultivating this highly desirable type of medical literature, so, in the language of Abou Ben Adhem, we say to both Horsley and Mosby, "May your tribe increase."

AND here at the end of the fiscal year, we have the usual Medical Annual. Only this time we have two of them: one American² and the other English.³ The two volumes are similar in that they

¹THE PRACTICAL MEDICINE SERIES, VOL. II, GENERAL SURGERY. Edited by John B. Murphy, A.M., M.D., LL.D., F.R.C.S. (Hon.) F.A.C.S. Chicago: The Year Book Publishers, 1915.

²THE MEDICAL ANNUAL & YEAR BOOK OF TREATMENT. Bristol: John Wright and Sons, 1915.

³SURGERY OF THE BLOOD-VESSELS. By J. Shelton Horsley, M.D. St. Louis: C. V. Mosby Company, 1915.

ing so much today as we did formerly is that we fear post-operative infection less and because proctoclysis or the use of solutions per rectum will greatly aid us. I would like to hear from him on that point in closing the discussion.

DR DODDRELLIN. I would like to ask Dr Goldstine whether he had many wound infections or stitch hole abscesses after these operations?

DR GOLDSTINE (closing). With regard to the first point concerning drainage, I will say that I am draining less and less in many cases. I do not drain as frequently as I used to, and I hope in five years from now to drain but very few; but I think in order not to drain one ought to have a long experience back of him to be able to substantiate his reasons for not instituting drainage. I hope to be able to do away with drainage entirely within a short time.

In regard to pyosalpinx following puerperal infection, the cases that were operated on for pus tubes were operated upon a long time after the infection occurred. We give these cases a good long time to clear up. It is a fact that where we get infection after childbirth, with a large exudate in the pelvis alongside the uterus the exudate may extend up as high as the umbilicus. If such a patient is kept in bed these exudates will clear up—at least nine out of ten will—and the patients afterward become pregnant.

As to salpingitis, I do not operate every case that comes to me. I feel that there are a number of

cases that get well with medical treatment, and I have a pregnant woman now I expect to deliver in whose case I made a diagnosis of salpingitis.

As regards post-operative treatment, it is the regular routine post-operative treatment we all use, I should judge, excepting the patients after they are taken from the operating room to their bedrooms, are made comfortable, perspiration is wiped off thoroughly, hot water bottles are applied to the feet, and no matter how cold the weather is, the windows are opened wide, the nurse is protected from the cold, and, the patients are covered up well and given all the fresh air they can get. This reduces nausea and vomiting after operation and patients seem to get along better, and so far I have no reason to change that method on account of post-operative pneumonia.

As regards the other treatment, if patients are in severe pain, we give them morphine hypodermatically to keep them quiet, and we let the bowels rest for forty-eight hours, after that time patients are given from two to three ounces of milk of magnesium as required and four hours after the last dose, if the bowels have not moved we give them an enema.

As regards stitch abscess and distention of the stomach, I have had about everything a practitioner could have post-operative, and I feel that when one operates enough cases he will get all that is coming to him. The cases of acute dilatation of the stomach are the hardest cases I have had to combat, and these occur when you least expect them.

In the final chapter, the plates illustrate several forms of congenital anomalies. The frequency of their occurrence with only the slightest symptoms makes the use of the pyelogram all the more valuable. In conclusion we may say that Braasch has settled beyond doubt the distinct advantages of pyelography, and that his careful observations have paved the way for further advance in urological diagnosis. B M

THIS recently published textbook on Cystoscopy and Urethroscopy by Lewis and Mark¹ requires little detailed comment. The authors call attention to the rapid advance in these methods of examination and the need of an up to date book for beginners, therefore they announce in their preface that the subject of their volume is "to portray the technique of cystoscopy and urethroscopy so graphically that the book might prove of real value to the novice." We are not convinced that they have been eminently successful in their efforts.

The volume is divided into two parts. (1) Cystoscopy, and (2) Urethroscopy. Under each heading the authors describe the technique both of inspection of the bladder and urethra and of operative procedures.

Far too much space is allotted to the presentation of the various types of apparatus needed for the work at hand and too little to the manner of using these instruments in actual examinations. Furthermore the same tendency to pass lightly over the subject is found in the discussion of the distortion of the images and other difficulties in the interpretation of cystoscopic and urethroscopic pictures. The chief tests of kidney function are given in including a verbatim quotation on the use of phenol sulphonephthalein from a paper of Geraghty and Rowntree, but no attempt is made to compare the accuracy or the limitations of usefulness of these various tests. The chapter on Uretero Pyelography, written by W. F. Braasch, and those devoted by the authors to the diseased conditions in the bladder and urethra are given far better attention and, although of necessity not elaborate, the text approaches much nearer the ideal instruction that a novice requires.

We fear, however, that the novice who may seek information in this book will criticize the authors for the superficial manner in which they have presented the subject. It does not seem particularly well suited for the use of beginners and offers very few features of value to the more experienced surgeons.

B M

¹ CYSTOSCOPY AND URETHROSCOPY. For general practitioners. By Bradford Lewis, B.S. M.D. F.A.C.S. and Ernest G. Mark, A.B. M.D. F.A.C.S. Philad. Lippincott, W. Blakiston's Son & Company 1915.

LET it be said forthwith, this² is a good book. It has evidently been written by one who has, out of love and inclination, delved deeply into his subject. The author's statements are clear, simple, and direct. When this much has been said high praise has already been given.

One misses the personal touch that lends charm to the production of clinicians like Osler, Dieulafoy, and Strumpell. The author seems to hold himself modestly in the background, a virtue which in an author of a textbook on a clinical subject easily becomes a failing. Thus, Aaron, in discussing carcinoma of the stomach, recites Salomon's test, Wolff and Junghan's test, Loeper and Binet's cystodiagnosis, Neubauer and Fischer's glycolytroph reaction, Gluzinski's test and fails to give us an appraisal of these methods, based either on his own experience or on reports of others.

The book is a large one of almost 800 pages bulky in fact, but there are omissions that seriously mar its usefulness to the general practitioner, for whom, according to the preface it is intended. In his chapter on examination of the faeces, Aaron makes no mention of the test for urobilinogen in the urine as an indication of the presence or absence of bile in the intestines, yet it is simpler and easier than Schmidt's sublimate test and fully as reliable. The relation of the endocrine glands and their secretions to diseases of the gastro-intestinal tract receives but scant notice and one misses a short discussion, at any rate, of the diarrhoea in Basedow's and Addison's diseases.

One more shortcoming deserves mention because it characterizes so many of the clinical treatises of today, namely, the tendency to dogmatize and schematize. As an example, witness the chapter on Chronic Constipation first, a short definition that falls far short of the mark then at once a subdivision into three varieties—tonic spastic, fragmentary. This is the sort of thing that leads students to believe that Dame Nature has studied medicine in one of our leading schools and acts accordingly. Schmidt says, "A sharp dividing line cannot be drawn between atonic and spastic constipation," a statement that makes us feel that here is a man who appreciates the complexity of the situation.

Still it is a good book. When we say that it must be read with some discrimination, we only say what must be said of most efforts of this kind. That textbook which can be read from one end to another and its contents accepted *in toto* is as rare as is the man with catholic mind to produce it. L S

² DISEASES OF THE DIGESTIVE ORGANS, WITH SPECIAL REFERENCE TO THEIR DIAGNOSIS AND TREATMENT. By Charles D. Aaron, B.S. M.D. Philadelphia and New York: Lea & Febiger 1915.

CORRESPONDENCE

A NOTE OF THANKS FROM DR. DEPAGE

To the Editor I enclose herewith the literal translation of a letter I have just received from Dr Depage, which he wishes to have published in acknowledgement of the many letters he has received from America since the tragic death of Madam Depage on the "Lusitania"

R H HARTE

Philadelphia

The translation of Dr Depage's letter follows

My dear Colleagues I have received from a large number of you and notably from the committees which you have formed, the most touching tributes of sympathy and of condolence for the catastrophe of the "Lusitania" in which my wife lost her life

These tributes are so numerous and so unanimous that I wish to express to you publicly my appreciation of them I address myself to you, my dear Colleagues, as the authorized representatives of the humanitarian sentiments which so honor the great American nation

You all know, as I wrote to you when my wife left for America, for what purpose she accepted the mission which the Red Cross confided to her In the presence of the unexampled miseries of which

we have been the prey, she had resolved to solicit your fraternal assistance You gave her that largely—I should say "joyously" if the word could be used in these times

The letters my wife wrote to me in the course of her mission told me how you worked for her, and revealed to me the extent and generosity of your projects for our wounded Your hearts were open to our appeal, your Country did not wait to come to our assistance Powerful America wished to take under her protection our little people, tortured but always valiant

My great sorrow does not permit me to reply as I wish I might to each one of you Only today have I been able to measure—thanks to the letter of your compatriot, Dr Houghton—the extent of the gratitude I owe, to him, first, for having risked his life in trying to save that of my wife, and after that to you all for your devoted help in our common work

Under the strain of my emotion, the sentiment of thankfulness is the only one to which at this moment I am able to give expression Permit me to do so with all my heart

A DEPAGE

La Panne, Belgium

THE BUTTON SUTURE IN COLPORRHAPHY

To the Editor In the May issue of SURGERY, GYNECOLOGY AND OBSTETRICS Dr S F Wilcox describes what he calls "The Button Suture" in anterior colporrhaphy This method is identical with the method described by me in my book *The Principles of Gynecology*, in 1910, and also in the *Journal of Obstetrics and Gynecology of the British Empire*, in 1911 Dr. Wilcox has made a slight

variation in the use of pearl buttons threaded on the mattress sutures I doubt, however, whether he can claim that such a slight and unnecessary alteration constitutes a new procedure The principle of the method is the important matter, and that was introduced by me, as already indicated

W BLAIR BELL.

Liverpool, England

Clinical Congress of Surgeons of North America

SIXTH ANNUAL SESSION

BOSTON

OCTOBER 25 TO 29, 1915

CLINICAL CONGRESS OF SURGEONS OF NORTH AMERICA

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THE HOSPITALS AND MEDICAL SCHOOLS OF BOSTON

III—TUFTS COLLEGE MEDICAL SCHOOL

By CHARLES F. PAINTER, A B, M D, F A C S, DEAN

TUFTS College, situated in Medford, Mass., was founded in 1852. At that time its charter authorized the trustees "to confer such degrees as are usually conferred by colleges in New England." It was originally a college of letters, but in its endeavor to adapt itself to the needs of the section of the country it has sought to serve, it now confers the following degrees: Bachelor of Arts, Bachelor of Philosophy, Bachelor of Science, Master of Arts, Doctor of Philosophy, Civil, Mechanical, and Electrical Engineer, Bachelor of Divinity, Doctor of Medicine, and lastly, Doctor of Dental Medicine.

Started under the auspices of the Universalist Church, it never has been a sectarian institution, and in coming into existence under denominational auspices it was simply following the tradition of many of its predecessors among New England colleges.

It is a coeducational college, in this regard again attempting to meet the public demands, when in 1892 it established Jackson College for women students. The coeducational feature has extended to the professional schools.

In the fall of 1893, Tufts College inaugurated a medical department, the first session of which was held that year in the building at 188 Boylston Street. This action was the result of some deliberation on the subject by the trustees of the college, who recognized the fact that a medical school, coeducational in nature, of high standard, moderate in charges, and located in Boston, where hospital facilities were to be obtained, was a necessity to New England. The step, however, was not taken without some misgiving because of the financial crisis of that period and the lack of endowment to aid in the establishment of a medical school in connection with this college. The location on Boylston Street, which the school occupied during its opening years, was hardly all that could be desired for such an institution. The corps of instructors, numbered barely twenty-five, the resources, the room, and the materials to work with were very limited, but the opening class was of a large size and the prospects of steady increase seemed good. The course was a three year one and the subjects taught were those of the usual medical school.

The following year found the school still in the

same quarters, which, however, had been greatly enlarged. There had been an increase in the number of instructors and improved clinical advantages. The number of students this year was greatly in excess of that of the preceding year. Gratifying as these results were, they necessitated the seeking of a larger home in which to carry on the work of the school.

In 1896 negotiations were opened and the necessary steps taken to install the school in a large building formerly the property of the First Free Baptist Church, located on the corner of Rutland Street and Shawmut Avenue. In the meantime, as temporary headquarters, the Chauncey Hall School building was rented; which place was occupied until the following year, when the school opened in its new building. This was a large stone structure fronting on three streets, containing some 15,000 feet of floor space arranged in lecture rooms, laboratories, dissecting and study rooms of the most improved description.

In the preceding year many radical changes had been inaugurated, the course was modified from a three- to a four-year one; a new dean was chosen, the faculty and corps of instructors greatly increased, and many other important steps taken which the growth of the school demanded. Here then for four years the school was located, each succeeding year bringing improvements in the curriculum, increased facilities for study and more ability to the ranks of the faculty. The rolls of the classes, too, showed an increase keeping pace with the improvements, and even outstripping them, until it became apparent that another move into still larger quarters was necessary in order to accommodate the unprecedented growth of the school.

This step was made all the more necessary by the fact that in the year 1899 the Boston Dental College became, under a special act of the legislature, an incorporate part of Tufts College. This transfer was the result of new laws of the state concerning the study of dentistry, which made it necessary that a dental school should have some connection with one of medicine. Therefore the work of the two schools became blended, with an increased strain on the resources and facilities found at the medical school building. In the meantime various steps were taken

to find a new situation for the two schools. After some consideration land was purchased upon the corners of Huntington and Rogers Avenues, Courtland and Driscoll Streets, the ground being broken for the new medical school building early in the autumn of 1900.

This building was occupied in the session 1901-02. Increasing requirements again necessitated more commodious quarters, and in 1910 the building was enlarged and remodeled at an expense of \$50,000. A fourth story was added, and the building is now equipped with every needful facility for teaching medicine in accordance with present requirements.

The faculty and board of instructors is composed now of about one hundred and ten members. The laboratory courses take the entire time of the professors giving instruction in those subjects.

The necessity for large endowment in order to put the clinical instruction upon full time basis, as well as some question as to the advisability of so doing to any considerable extent, has kept the school from even considering entrance upon this experiment. The enrollment in the school is slightly better than three hundred students on the average. The tuition fees have been kept as low as has been consistent with giving good advantages to the student both in scientific and clinical subjects.

This and certain tendencies in the shaping of the curriculum of the school have been dictated largely by the desire to lay emphasis in the instruction upon the training of general practitioners, more than upon that of highly trained specialists. The latter are desirable and necessary, but the two can not be advantageously carried on in the same courses. There is much that must be taught to the highly trained research man that the physician in general practice in the rural districts need know nothing about. The cost of giving him instruction along these lines is high, particularly so when the value of much of it to the science of medicine is problematical, and for this particular class of practitioner it is useless.

In meeting the increased educational requirements for entrance upon the study of medicine, the trustees have authorized the giving of a premedical course of one year of college work in biology, physics, chemistry, and either French or German. These courses are given at the medical school. The faculties of the medical, arts, and scientific departments of the college have united to aid in the conduct of these courses in order that the student may lose nothing of the advantage of

a college course in these subjects, and may, at the same time, have his premedical year bear as practically as possible upon the subjects to be pursued later in the medical school and in practice. The language courses are designed to enable men to read scientific French and German, which the average college graduate can not do by the time he has entered upon the practice of medicine without post-graduate study. Physics and chemistry have been similarly modified from the manner of giving them ordinarily in the college of arts, that they may interest the prospective medical student in the practical applications of those sciences to the problems of medicine.

In the minds of those who have given these courses so far, there is no doubt of the practicability of conducting them in this way. There is nothing pedagogically wrong in this plan when handled by the combined faculties of an arts college and its medical department.

The administration of the professional affairs of the school is vested in two committees, chiefly. One is the administrative committee, acting as an intermediary between the faculty and the trustees and dealing with appointments and the budget largely. The financial affairs of the school are administered from the office of the trustees of the college. Matters relating to the arrangement of the curriculum, details of the student's relations with the school work, admission requirements, etc., are handled by a committee on instruction, composed of a representative from each of the six departments into which the work of the school is divided. Full faculty meetings are held only three or four times during the year unless especially called.

A brief statement of the general organization and plan of instruction in the six departments of the school's activities follows.

The departments of anatomy, histology, and pathology act as a unit in the committee work of the faculty. For many years the teaching of these subjects and all others of the first two years has been upon the concentration plan, but a year or more ago, now, the faculty voted to return to the older method under which the subjects of these two years were taught throughout their respective years, the reason for this return to the older method being that a better correlation of the subjects taught can be secured in this manner. When this plan is completely in operation, anatomy will continue through the entire first year, as will also histology. The former will continue into the second year as topographical anatomy, where it will be correlated with



Tufts College Medical School Building

beginning courses in medicine and surgery, to which it will be a helpful adjunct

Pathology commences in the second year and when the concentration method is over will run through the year as a laboratory and lecture course, and be carried into the third and fourth years as a demonstration course in conjunction with the department of medicine. Histology and embryology are completed at the end of the first year

This department, represented by its faculty members and instructors, as do all other departments under similar departmental organization, meets to discuss its own particular problems of instruction and annually chooses one of its faculty members and an alternate to make up the important committee on instruction

The biology teaching of the premedical year is carried on by the professor of histology in conjunction with the biological department of the college of arts. The departments of chemistry, physiology, pharmacology, and therapeutics are organized under one unit and so represented on the committee of instruction

Physiology will be taught through the entire first year running parallel with descriptive anatomy. The general chemistry of the premedical year, as well as the physiological chemistry, is

handled by the professor of chemistry. The latter course will begin in the second semester of the first year and will be completed at the end of the first semester of the second year. The first part is physiological chemistry, the second is chemical pathology and toxicology. In this way the subject is brought to the students' attention at a time when it can be related to his physiological studies on the one hand, and the commencement of some of his distinctively medical studies on the other.

Pharmacology is commenced in the second year as a lecture and laboratory course. The amount of time and expense involved in conducting an elaborate course in experimental pharmacology has never seemed to be justified by any practical value it might have to a general practitioner, so the emphasis is laid elsewhere in the conduct of the courses in this subject. A course in applied therapeutics is arranged for the third and fourth year students, and is given at the Robert Brigham Hospital. Practical therapeutics is taught at Tufts in a way which we believe is different from that of any of the other medical schools. Therapeutics is usually given in the department of clinical medicine. It is taught at the bedside incidental to instruction in symptomatology and etiology. There are, nevertheless, certain gen-

J H CUNNINGHAM—4 30 Demonstration Congenital cystic kidney, results of operations for intestinal tuberculosis, nephrectomy for acute unilateral haemorrhagic infections of the kidney

I H LAHEY—5 Demonstration Carcinoma, carcinoma of the jejunum, resection of the rectum with perineal anus

Friday

F S NEWELL, E B YOUNG, and N R MASON—9 Operations Gynecological

E H NICHOLS, H A LOTHROP, and J C HUBBARD—2 Operations Surgical

E H NICHOLS—3 Demonstration Results and methods of operating for osteomyelitis, cerebral surgery

H A LOTHROP—4 Demonstration A new operation on the frontal sinus

J C HUBBARD—5 Demonstration Sarcoma of the femur, excision of the transverse colon perforation of duodenal ulcer, transverse duodenal removal of a gallstone, rupture of the liver

In connection with the operative clinics, demonstrations of special methods of anesthesia—intratracheal spinal, etc.—will be given, where possible, by J E BUTLER, F L RICHARDSON, and N N MORSE

CHILDREN'S HOSPITAL

Orthopedic Department

R W LOVETT, A THORNDIKE, ROBERT SOUTTER, A THORNFRIED, A T LEGG, J W SPAFF, and HENRY J FITZSIMMONS—Daily 9 to 11 Orthopedic operations Reduction of congenital dislocation of the hip by various methods, and especially by a special machine, tendon transplantations capsule reefing, etc., in infantile paralysis the use of silk ligaments in infantile paralysis, the operative correction of club foot, the Hibbs and Allie operations for tuberculosis of the spine the operative treatment for spastic paralysis, operations for cota vita bone transplantations

R W LOVETT—Monday 2 10 and 5 10 Demonstration The treatment of infantile paralysis by muscle training, with exhibition of patients. The treatment of scoliosis by forcible jackets Application of jackets and demonstration of results

ROBERT SOUTTER and A T LEGG—Monday 3 15 Demonstration Exhibition of the results of the operative treatment of infantile paralysis

F G MARTIN—Monday, 3 30 Demonstration An apparatus to determine the strength of muscles affected by infantile paralysis with conclusions to be drawn from observations made by it

J J THOMAS and J W DELVER—Monday 4 Demonstration Obstetrical paralysis and fracture of the acromion process simulating it

Monday, Tuesday, and Wednesday, 3 Demonstration Treatment of paralysis by muscle training

A THORNDIKE—Monday, 4 30 Demonstration End results in osteomyelitic operation for spinal tuberculosis

PERCY BROWN—Monday, 4 50 Demonstration Röntgen results in osteoplastic spinal operations

Thursday, 4 Demonstration Result of röntgen investigation in cases of fibrous stenosis of the pylorus in children

Daily, 10 to 4 Exhibition of röntgenograms, röntgen department

ROBERT SOUTTER—Thursday 3 Operation A new operation for flexion contraction of the thigh in infantile paralysis

A T LEGG—Thursday, 3 30 Operation Transplantation of the origin of the pectoralis major muscle in paralysis of the shoulder.

A THORNFRIED—Thursday, 2 30 Demonstration Multiple enchondroma

H J FITZSIMMONS—Monday, Tuesday, and Wednesday, 3 Demonstration Treatment of scoliosis with methods in use, cases and records

Thursday, 4 20 Demonstration Apparatus for reduction of congenital hip dislocations

PROFS ERNST, FOLIN, HUNT, CANNON, and WOLBACH, Drs STONE and MORSE—Thursday, 4 30 Clinic Infantile paralysis

Visit to orthopedic wards daily, 11 to 12 The new hospital buildings will be open to inspection by visitors daily, 9 to 10

Surgical Department

J S STONE, W E LADD, C G MIXTER, and T W HARMER—Daily, 11 to 1 Surgical operations Hernia, cleft palate empyema, hernia cervical adenitis, webbed fingers hypoplasia undescended testis, etc

C G MIXTER—Tuesday, 2 30 Demonstration Imperfect and ectopic anus

Wednesday 2 30 Demonstration Tuberculous peritonitis, pyloric stenosis undescended testis

W E LADD—Tuesday 2 30 Demonstration Cervical adenitis

Wednesday, 2 30 Demonstration Intussusception, harelip and cleft palate

J S STONE, W E LADD and J J THOMAS—Tuesday, 2 30 Demonstration Fractures in children, subperiosteal and epiphyseal, elbow joint fractures, Volkmann's ischemic contractures

J S STONE—Wednesday 2 30 Demonstration Some obscure abdominal conditions empyema, harelip, and cleft palate acute epiphyseal lesions

T W HARMER—Wednesday, 2 30 Demonstration The treatment of birthmarks

PROFS ERNST, FOLIN, HUNT, CANNON, WOLBACH, Drs LOVETT STONE and MORSE—Tuesday, 4 30 Clinic Cervical adenitis

Drs CROSBY GREENE, and J F GARLAND, three after noons Eye, ear, nose and throat clinic

Visit to general surgical wards daily, 10 to 11

MASSACHUSETTS HOMOEOPATHIC HOSPITAL

Monday

A G HOWARD and H MOORE—9 Orthopedic operations Bone grafting tendon transplantation

J H PAYNE and D W WELLS—9 Eye operations Advancement, pulley suture advancement modified Worth, ptosis Tandy operations, trephining, glaucoma

Drs RICE, HOLCOMB and C SMITH—2 Operations Nose and throat

W F WESSFLORE and T F CHANDLER—2 General surgical operations Gastric ulcer ventral hernia, inguinal hernia appendicitis oesophageal diverticulum

Tuesday

J I BRICES and C F HOWARD—9 General surgical operations Prostate, appendix, goiter inguinal hernia

C A STARR and A W HARR—9 Eye operations Muscle tucking advancement, modified Worth, cataract extraction glaucoma

HORACE PACKARD and C T HOWARD—2 General surgical operation Appendectomy, a simpler method of sealing the appendicular stump Demonstration cases Prostatectomy, the choice of routes, the control of post-operative hæmorrhage, illustrative operations, empyema, cases for demonstration, enteroptosis, cholelithiasis

Drs RICE, HOUGHTON, and SMITH—2 Operations Nose and throat

Wednesday

Drs RICE, HOUGHTON, JOHNSON, SMITH, and BUSH—9 Operations Nose and throat

GEORGE H EARL and H MOORE—9 Orthopedic operations Congenital dislocation of the hip, bone grafting, tendon transplantation

W I WESSLEHOFF and R C WIGGIN—2 General surgical operations Nephrolithiasis

F W COLBURN—2 Operations Ear

Thursday

J E BRIGGS and C CRANE—9 General surgical operations Cancer of the breast, appendix, cholelithiasis, nephrolithiasis

Drs RICE, HOUGHTON, and C SMITH—9 Operations Nose and throat

G R SOUTHWICK—2 Gynecological operations Ovarian cystomata, retrodisplacement of uterus, uterine fibromata, perineorrhaphy

Friday

G R SOUTHWICK and D G WILCOX—9 Gynecological operations

Drs A S BRIGGS, BOYD, LEE, SEDGWICK, SOUTHER, and THOMAS—2 General surgical operations

Demonstrations

W H WATKINS—Surgical pathology

G A SUFFA—Ophthalmotrope

Routine examination of ante-partum cases—Wednesday 10

Social service clinic for post partum cases—Thursday, 2

Daily clinics in twilight sleep

Daily exhibition of new maternity building

FREDERICK BENT BRIGHAM HOSPITAL

HARVEY CLISHING—Daily Clinics or demonstrations Surgery of the brain pituitary body, spinal cord, peripheral nerves

DAVID CHIFFER and JOHN HOMANS—Daily Operations Surgical

HENRY A CHRISTIAN, CHANNING FROTHINGHAM and others of the medical staff will cooperate in giving clinics or demonstrations on selected topics, such as the electrocardiogram etc

FRIE HOSPITAL FOR WOMEN

Drs GRAVES, PEMBERTON, WADSWORTH, HUTCHINS, and BAKER—Tuesday, Wednesday, and Thursday 9 Operations Gynecological

Dr PEMBERTON—Wednesday 2 30 Cystoscopic demonstration

Dr HUTCHINS—Thursday, 2 30 Demonstrations Laboratory specimens

ST. ELIZABETH'S HOSPITAL

Drs LANE and SUPPLE—Monday and Thursday, 9 Operations

Dr M J CROVY—Monday, Thursday, and Friday, 10 Ward visit

Wednesday, 9 Intravenous salvarsan injections

Dr T F BRODERICK—Tuesday, 9 Orthopedic operations and clinic

Dr. A. L. CHUTE—Wednesday and Friday, 9 Operations Genito urinary

Drs BRAINERD and HOLMES—Tuesday, 9 Nose and throat clinic

Dr A F DOWNING—Monday and Friday, 11 Demonstrations Laboratory technique

Dr P F BUTLER—Tuesday and Thursday, 10 Demonstration Radiography

Drs McDONALD and McDONALD—Wednesday, 10 Eye clinic

The history, diagnosis, and indication for operation in each case will be discussed previous to operation by Dr Cronin of the medical service and Dr Butler of the roentgenological department

ROBERT BRIGHAM HOSPITAL

CHARLES F PAINTER, EDWARD RICHARDSON, LLOYD T BROWN, and RICHARD MILLER—Tuesday and Thursday—10 Operations

Monday, Wednesday, and Friday, 3 Clinics Surgery of chronic diseases arthritis, intestinal tuberculosis, peritoneal adhesions, hæmolytic diseases

NEW ENGLAND HOSPITAL FOR WOMEN AND CHILDREN

MARY A SMITH and ABBY M O'KEEFE—Monday and Thursday, 10 Operations Gynecological

ELIZABETH T GRAY and LETITIA D ADAMS—Monday, 2, Tuesday, 10 Operations Gynecological

EMMA B CULBERTSON and GLADYS COOPER—Tuesday and Friday, 2 Operations Gynecological

FLORENCE DUCKERING and LETITIA D ADAMS—Wednesday 10

Thursday, 2 Operations Gynecological

MAUDE CARVILL—Thursday, 2 Eye clinic

MARGARET NOYES—Wednesday 2 Ear, nose, and throat clinic

ISABELLE D KERR—Friday 10 Ear, nose and throat clinic

Scopolamine morphia anesthesia both with and without ether will be used during these clinics Statistics, covering six years continuous use of this form of surgical anesthesia on over 1,400 cases, are available Dr Abby M O'Keefe, professional anesthetist, has entire charge of this department

LONG ISLAND HOSPITAL

F H LAHEY—Monday 2 Operations

J H CUNNINGHAM—Tuesday and Wednesday, 2, Operations

ROBERT SOUTTER—Thursday and Friday, 2 Operations

CARNEY HOSPITAL

J T BOTTOMLEY and D I MAHONEY—Monday, Wednesday, and Friday, 9 Operations Surgical

W R MACATSLAND and A R MACATSLAND—Monday, Wednesday, and Friday 9 Operations Orthopedic

F W JOHNSON and S REYNOLDS—Tuesday and Thursday, 9 Operations Gynecological

CODMAN HOSPITAL

F. A. CODMAN—Tuesday, 10 Operations Surgical Demonstration of lesions about shoulder joint.
Thursday, 10 Operations Surgical Demonstration of lesions of diaphragm

HOUSE OF THE GOOD SAMARITAN

DRS. SOUTER, LEON, and SEYER—Monday, Wednesday, and Friday, 10 Clinics Infantile paralysis, muscle transplantation, flattened condition of the head of the femur, obstetrical paralysis

TUFTS MEDICAL SCHOOL

A. W. GEORGE—Daily, 2 to 3 Demonstrations Rheumatology

MASSACHUSETTS CHARITABLE EYE AND EAR INFIRMARY

DRS. CROCKATT, MORTER, and FERRIS—Monday and Friday Otolological clinic

DRS. JACK, WALSH, POWERS, and BERGOTT—Tuesday Otolological clinic

DRS. HAMMOND, WHITE, and FAUCET—Wednesday Otolological clinic

DRS. JACK, KNOWLES, TORRE, and LEWIS—Thursday Otolological clinic

Eye clinic daily from 9 to 12 Various operations on lids, tear sac, and muscles of the eye Different types of operation for cataract and glaucoma Magnet operations for the removal of foreign bodies from the eye Different methods of using local anesthesia Tuberculosis of the eye Interstitial keratitis of specific origin Ophthalmia neonatorum and gonorrheal ophthalmia in adults Local fixation of foreign bodies in the eye by the X-ray Demonstration of ophthalmometer for measuring astigmatism of the lens Demonstration of lantern slides by pathological department

BOSTON DISPENSARY

W. M. CHASE and H. E. DAY—Surgical clinic
JOHN ADAMS—Orthopedic clinic

HENRY J. PERRY and ARTHUR H. CROSSBY—Genito-urinary clinic

FORSYTHE DENTAL INFIRMARY

FRANK B. LEACH—Monday, 9 Surgical operations
HARRY H. GERMAIN—Tuesday, 9 Surgical operations

HELEN WILLIAMS—Wednesday, 9 Surgical operations

HENRY CABOT—Thursday, 9 Surgical operations

WILLIAM L. CHENEY and LOUIS ARKIN—Daily, 10 Nose and throat clinic

L. M. S. MINER—Tuesday, 2 Oral surgery

HARRY B. SUMNER—Wednesday, 2 Oral surgery

ALBERT L. MINNERY—Thursday, 2 Oral surgery

DR. STANLEY—Friday, 2 Oral surgery

ALBERT KINLEY JR.—Daily, 11 and 2 Radiography

WILLIAM A. GORIE—Daily, 11 and 2 Extracting clinic

WILLIAM F. HILL—Daily, 9 and 2 Operative dental clinic

FRANK A. DELARABEE—Daily, 9 Orthodontic clinic

Research Laboratory will be open from 9 to 12 and 2 to 4 daily Exhibition of pathological and bacteriological specimens

HARVARD MEDICAL SCHOOL

FRANK CANNONMAN and MALLORY—Demonstration Pathology

FRANK CANNON and W. T. PORTER—Demonstration Physiology

LESLIE LOUIS—Demonstration Chemistry

FRANK STROUD—Demonstration Tropical Medicine

FRANK KIPP HUNT—Demonstration Pharmacology

DRS. CHOWMAN and TYLER—Demonstration Cancer research

JOHN WARREN—Demonstration Anatomy

W. F. WHITNEY—Demonstration Warren anatomical museum

F. T. LEWIS—Demonstration Embryology

J. L. GOLDTHWAIT—Demonstration Viscerology

SURGERY, GYNECOLOGY AND OBSTETRICS

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RECONSTRUCTION OF THE COMMON BILE DUCT

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THE lesions of the gall-bladder and ducts which give rise to the greatest difficulty at operation are those where there is an irremovable obstruction of the common bile duct. Fortunately, in the majority of cases, this obstruction is slow in onset and is situated near the termination of the common duct. For this reason the dilatation of the gall bladder and ducts together with the marked jaundice give a clear indication of the site of the lesion and it is not as a rule difficult to determine whether the obstruction is due to a calculus, a stricture or a new growth at the termination of the duct. In the latter cases a cholecystenterostomy can readily be performed and the obstruction thereby overcome. In certain cases however this operation may be impossible, for owing either to an error of diagnosis or to the nature of the lesion, the gall bladder may have been removed previously or the common duct may be obstructed or even destroyed to such an extent that the cystic duct is involved in the process. It then becomes necessary to perform an operation in which a junction is made between the distended duct and the intestine or an attempt must be made to form a new duct out of some adventitious tissue.

From the technical point of view these cases may be divided into two groups.

In the first the gall bladder either is absent or is so small that it is valueless for

the purpose of performing an anastomosis. There is an impassable obstruction to the passage of bile but there is no biliary fistula. In such cases it is often immaterial whether the common duct persists throughout the whole of its length or is absent in part. The important factor is that the duct is dilated and generally to so marked a degree that it is not difficult to form an anastomosis between it and the intestine.

In the second group, in addition to the absence of the gall-bladder and the impassable obstruction there is a biliary fistula, and hence the patent portion of the duct is of small size so that anastomosis becomes difficult or impossible.

The operation of anastomosis or choledochenterostomy was first performed by Riedel in 1881 a bilateral anastomosis being carried out between the dilated duct and the duodenum. The patient, however succumbed owing to the leakage of infected bile. In 1891, Sprengel performed the first successful operation of this nature, having previously removed the gall bladder. Since this date the operation of lateral anastomosis has not infrequently been carried out. In many cases as in those of Czerny, Swain (24), and Fullerton (7), a Murphy button was used to effect the junction. In other cases the anastomosis has been performed by simple suture after the manner of a gastro enterostomy, either with or without the use of clamps,

as in a case mentioned by Rowlands (19) Owing to the depth of the wound, at the bottom of which the anastomosis is not infrequently has to be performed, it may be difficult to place the sutures so accurately that no leakage occurs. For this reason, Horz (11) suggests that the anastomosis, which is made laterally, should be performed around a rubber tube the lower end of which is brought out through a second opening in the duodenum and drained externally, the tube being removed on the eighth day. He states that thereby the chance of leakage is diminished and that after the tube is removed the small duodenal fistula rapidly heals. Experience of the troublesome nature of duodenal fistula in general would however lead one rather to doubt that so happy a result could be looked for in every case. Of late this danger of leakage seems to have been surmounted, for Sasse (20) advocates that the operation should be more frequently performed and should even be undertaken in cases of obstruction by a calculus thereby allowing freer drainage to the duct. He opens the duct by means of a vertical incision removes the stone and sutures the edges of the incision to those of a corresponding incision in the duodenum. He reports ten cases in all.

It is in the second group of cases, however, that the greatest difficulty will arise and an investigation of the methods which have at present been employed shows that they are far from perfect and are liable to give rise to complications. Two varieties of operation have been performed in which no attempt is made to reconstruct the common bile duct. The first group is that of hepaticoduodenostomy or hepaticojejunostomy. In this operation a portion of the liver is excised so that a raw surface is left which presents the cut ends of several small intrahepatic bile ducts. An opening is then made into the duodenum or, if more convenient, into a loop of the jejunum the edges of the incision being sutured to the margins of the cut liver surface. It is hoped that thereby the bile will pass from the cut intrahepatic ducts into the lumen of the intestine. This operation has several grave objections. In the first place the bleeding from the cut liver surface is

difficult to control, secondly, it is not an easy matter to suture the intestine accurately and firmly on to the cut edge of the liver, and thirdly, as in the case reported by Lameris (13), there is danger of infection spreading from the lumen of the intestine into the intrahepatic ducts. In his case the patient died five months after the operation, and although there were about ten openings discharging bile from the liver into the intestine there were multiple abscesses in both lobes of the liver. The other type of operation which is not directed toward the common bile duct is that of von Stubenrauch (25). In this operation, which was based on theoretical considerations alone, an attempt is made to form a junction between the intestine and the fistula. A loop of jejunum is divided and the proximal segment laterally implanted into the distal segment. The proximal end of the distal segment is now passed subcutaneously from the operation wound and implanted into the side of the biliary fistula. Even on theoretical grounds this operation has the objection that should the anastomosis succeed the bile will in part of its course continue to pass along a fistulous track which will tend to become stenosed. Of more importance than this, however is the fact as shown by the first operation carried out by this method and reported by Sutton (23) that not only may the biliary fistula not close but a fecal fistula may be superadded.

The operations dealing directly with the common bile duct may be of three varieties

1. The use of autogenous tissue grafts
2. Direct implantation
3. Indirect implantation

Autogenous tissue grafts. Our present knowledge of tissue grafts is such as to lead to the belief that autogenous tissue can alone be used with any chance of success. For this purpose a variety of structures have been used but the work on these lines appears to have been limited either to dogs or to the cadaver. Giordano and Stropeni (9) advocated the use of a portion of vein. Similar experiments were carried out by Giacinto and Luigi (8) a portion of a vein being used as a graft to fill an artificial gap in the common duct of dogs. The operation was completely

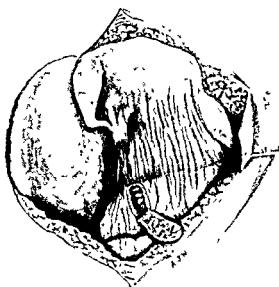


Fig 1 Showing duct divided and opening made into duodenum

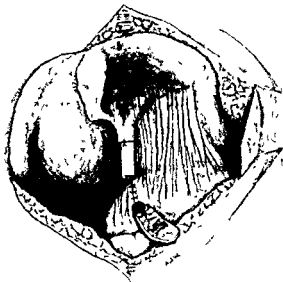


Fig 2 Tube sutured in duct, opening in duodenum partly sutured

successful but in this case the difficulty of fashioning a suitable opening into the duodenum was not encountered a portion of the common duct being left both above and below the graft. Davis (5) in order to test the value of vein tissue for this purpose, grafted a piece of vein into an opening made in the gall bladder of a dog. The dog was later killed and it was found that the graft had taken perfectly.

The use of the appendix has been suggested by Molineux (17) who advocates that this viscus should be removed from the patient himself. He has however carried out the operation only on the cadaver. If, as one believes it is important that the appendix should come from the patient himself, the operation would labour under the disadvantage that in many cases the viscus would not be sufficiently healthy to form a suitable duct.

Lewis and Davis (6) have made use of portions of transplanted fascia from the abdominal wall to bridge gaps in the common bile ducts of dogs. At the end of two months the grafts were healthy and formed a satisfactory duct.

The operations above described may in the future prove of very considerable value, but at present in the human body at least, it is difficult to say what is the exact value of such grafts. It may be found that neither the tissues of veins, of fascia, or even of the appendix may be able to withstand the action of the bile. In any case, such an operation involves the use of a somewhat difficult technique, for the suturing of the grafts has to be carried out often at a considerable depth from the surface and has moreover to be so adequately carried out that little or no leakage will take place from the line of suture.

Direct implantation. This operation was apparently first carried out by W. J. Mayo (16) who reported two cases in one of which the common duct, and in the other the hepatic duct, was directly implanted into the duodenum. Similar operations have been performed by Packard (18), Harrington (10), and White and Lund. In Packard's case an ulcer was found occluding the duct at the papilla of Vater. The common duct was isolated and cut off from the duodenum. A puncture being made in another portion of the duodenum, the cut end of the common

duct was drawn through and sutured to the duodenal mucosa. The muscular wall of the gut was now folded over the duct in order that the latter might run an oblique course through the intestinal wall and hence have a valvular opening.

Wherever possible this is unquestionably the operation of choice, as no new tissue is employed to undertake the functions of the common duct. Unfortunately, however, it not uncommonly happens that the duct is not sufficiently long to allow of successful reimplantation. So large a portion of it may be destroyed that it cannot even be brought into contact with the duodenum and much less is there sufficient to allow the formation of a valvular opening. In certain cases this difficulty may be overcome by implanting it, not into the duodenum, but into a loop of jejunum. Such a case as this was reported by Jackson (12), where an obstruction of the common duct together with a biliary fistula resulted from an operation for carcinoma of the stomach. The upper patent portion of the duct was dissected out and divided. The cut end would not reach the duodenum, and hence a loop of small intestine was brought up to it and sutured to the liver to relieve tension. The bile duct was inserted obliquely into it, the anastomosis being made around a rubber tube.

The small intestine should always be chosen in preference to the colon for, as Weidemann (26) has shown, a junction between the gall-bladder and the colon in dogs is followed by a fatal ascending infection.

This operation however is not applicable to all cases for it may not be possible to bring the loop of small intestine sufficiently high up without causing kinking of the large or small intestine.

Indirect implantation. This method is one which has been used to surmount the difficulties arising when a considerable portion of the common duct is destroyed and when it is found that neither the duodenum nor a loop of small intestine can be drawn sufficiently far up to allow of direct implantation of the duct. For this purpose some modification of the method advocated by Sullivan (21 and 22) is usually performed. He advised that a

rubber tube be inserted into the stump of the hepaticus or choledochus and fixed there with an unabsorbable suture. The lower end of the tube is then inserted into the duodenum, the opening being made valvular by suturing the wall around the tube in the same manner as in a Witzel gastrostomy. The tube is then surrounded by a layer of omentum so that, if it be passed, a fistulous track lined by omentum will be left passing from the duct to the lumen of the intestine. Such an operation has been several times carried out. Brewer (2 and 3) reports one case in which the patient recovered entirely, but the tube was not found in the stools and it is doubtful whether it had been passed. A second case in a woman reported by the same author, died later apparently from obstruction. In both these cases the tube was wrapped round with omentum but in neither case apparently was the opening into the intestine made of a valvular nature. Mann (14) also records a case in which two years after an operation of cholecystectomy it was found that the common bile duct was destroyed and the common hepatic duct ended abruptly. A tube was inserted into the duct, sutured in position and the other end fastened into an opening into the duodenum after the Kader-Senn method of performing gastrostomy. The duodenum was then drawn up as close to the duct as possible. In this case also it was not known whether the tube had been passed but five months after the operation the patient was greatly improved. Brandt (1) reports five cases from Wilms' clinic these being the same five cases reported by Wilms (27). These operations were performed by Sullivan's method. In the first two cases a silk thread attached to the upper end of the tube led through the common bile duct into the duodenum and from there out through the abdominal wall. In the first case the tube was apparently left in place the silk thread being pulled out alone. In the second case the tube was removed through the abdominal wound. The third case vomited up a second tube which had replaced the first one which was insufficient. In the fourth case the lower end of the tube was inserted into the stomach and this tube also was vomited and

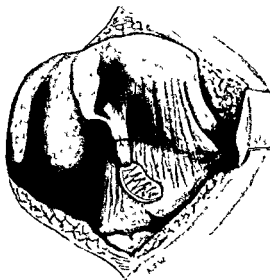


Fig 3 Tube inserted into duodenum drawn up as close as possible to common duct

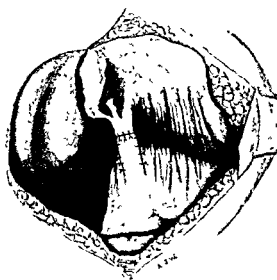


Fig 4 The duodenal flap sutured around the rubber tube

had to be replaced. The fifth case apparently made an uninterrupted recovery. The first three cases gave rise to a long after treatment, the tubes being free in the peritoneal cavity and uncovered by omentum, but in the end all the cases recovered.

On theoretical grounds the objections to the above operation are, firstly, that the new duct is formed of omentum and hence is at best a fistulous tract. It is therefore very liable to stenose, a complication that probably occurred in Brewer's second case. Secondly, in order to form a firm wall to the fistulous tract, it is necessary that the tube be retained in place for a long period. For this purpose it must be fixed with an unabsorbable suture, and therefore may remain permanently in place as probably happened in several of the above reported cases. One would believe that in such cases the tube would be very liable to give rise to infection, partly because its presence would lead to prolonged irritation and partly because, being rigid, it would prevent any opening into the intestine, however carefully made, from acting in a valvular manner. It is also fully realized that any foreign body in the gall-bladder or

ducts is very prone to lead to gall-stone formation.

A consideration of the above objections led me to devise the operation which I carried out in the following case and which I believe to be free from these drawbacks.

J L, age 27, a porter, was admitted to the hospital on May 9, 1914. He stated that eight years ago he had been jaundiced for about six weeks when a soldier in South Africa. The attack commenced with severe abdominal pain which doubled him up and lasted for four days. He had remained in bed for two weeks. He recovered from this attack and remained perfectly well until nine months before admission, when he again had a sudden onset of severe abdominal pain beneath the right costal cartilages and radiating from there to the back. The pain was continuous for the first day and was severe. It continued for the next four days, but was less severe. He vomited several times, but was never jaundiced. There had been no urinary symptoms. He recovered from this attack and remained well until eight days before admission, when there was another attack of pain, similar to the last, which lasted three days. The day before admission there was a less severe attack, lasting only a few hours. In neither of these later attacks was there any jaundice. There had never been any dyspepsia and the pain had no relationship to food. There had never been haematemesis nor melæna and he had never had malaria.

On admission his temperature was 98° and his pulse 76. There was no jaundice. On examination the abdomen moved easily and no swelling could be felt. There was some deep tenderness in the region of the gall bladder. His pupils were equal and reacted, and the reflexes were normal. The blood examination showed no leucocytosis and the Wassermann reaction was negative. A test meal showed 0.07 per cent of free hydrochloric acid, total acidity 45.

Operation, May 13, 1914. A five inch vertical incision was made over the upper right rectus. The gall bladder appeared normal and was not dilated. There was nothing abnormal to be seen in the stomach or duodenum. The common duct was not dilated. The pancreas was hard and there were a few hard nodules in the region of the common duct behind the duodenum. It was uncertain whether these were calculi in the common duct. The duodenum was opened, but the papilla appeared normal. The opening was therefore closed. The common duct was opened but no stones were felt. A probe could not, however, be passed down to the duodenum. A diagnosis of chronic pancreatitis was made, but as the bile duct was not dilated it was decided not to perform cholecystenterostomy. As the probe would not pass down the duct, it would have been better to have done this. The common duct was closed with interrupted catgut sutures and a small drain inserted down to the opening. On the fourth day the tube was removed. A Cammidge "C" test was made and was strongly positive, thus supporting the diagnosis made at operation. On May 20 bile was flowing freely from the wound and the stools were clay-colored. This condition persisted until June 3 when it was decided to carry out a second operation.

The old incision was opened up and the gall-bladder was now found to be small and shrunken. Careful dissection showed the common duct ending abruptly about a quarter of an inch below the junction of the cystic duct. Below this the duct could not be recognized being replaced by scar tissue (see Fig. 1). A flap was cut out of the duodenum and turned downward (see Fig. 1). A tube was inserted into the end of the common duct and sutured in place with twenty day chromic catgut. The opening in the duodenum was sutured in its upper part, leaving only an opening sufficient to admit the tube (see Fig. 2). The tube was inserted into this opening, the duodenum being drawn up as close as possible to the cut end of the duct with a catgut suture (see Fig. 3). The flap of duodenal tissue was now sutured around the rubber tube so as to make

a new bile duct (see Fig. 4). catgut sutures being used. A small drainage tube was inserted down to the junction. On June 8, there was no leakage of bile from the wound, the stools were well colored with bile, and the drainage tube was removed from the wound. On June 14, the rubber tube was passed per rectum and the wound was quite dry. On June 22, he was discharged from this hospital, the wound being quite healed and there being no symptoms. On July 28, he was quite free from symptoms and his appetite was good. There had been no attack of the original pain. On October 27 he was seen again. He stated that being a reservist he had been called up to the army and for two months had been working hard at his military duties in camp. During this time he had been quite free from any symptoms. He has since gone to the front.

I believe that the above operation gives a simple and satisfactory method of dealing with these difficult cases. A new duct can be readily formed of practically any length. It is lined by mucous membrane which is impervious to the action of bile and being lined by such a membrane will show no tendency to contract. At the same time the opening passes obliquely over the duodenal surface and hence there will be a well-defined valvular action. Owing also to the presence of the mucous membrane it is possible so to insert the tube that it can be passed without fear of complications in a few days' time, and no difficulty will therefore arise from the tube remaining as a foreign body.

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GUNSHOT WOUNDS OF THE LARYNX

REPORT FROM THE BATTLEFIELD IN RUSSIAN POLAND

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POINTED bullets can pass through the neck without injuring any of the vital organs of this region. Very frequently we see men who have been shot from the front, from the side, and diagonally through the neck, who have not the slightest trouble. On the other hand we see men who have been shot suffering from injuries of the plexus, of the vessels, of the air passages, and of the esophagus. In injuries of the vessels, surgical help is usually too late, as the victims die from hemorrhage, a circumstance which I have often witnessed on the battlefield. The most terrible and tragic sight is the man who has been injured through the spinal column of the neck. He is totally paralyzed, and his upper extremities are so hypersensitive that he screams when you touch him.

The severest injuries to the air passages I saw when I was in the front line in the First Aid station, 800 yards behind the firing line (Schwarmlinie) as we call it, and the second time 1200 yards back of this line and in front of our own artillery. The first case was a transversal gunshot wound through the larynx. Emphysema of the skin upward to the borderline of the hair and downward to the nipples was present. The soldier had great difficulty in breathing and was very

blue. I immediately performed a tracheotomy, and the next day the emphysema receded. On the third day he had fever, and there was difficulty in breathing through the larynx, although the larynx was free. The soldier died, but I could not do a post-mortem because as I started to leave the house, it was hit by shrapnel and demolished.

The second case showed a very small point of entrance on the right shoulder and no point of exit. In this case, too, emphysema was present up to the hairline, extending laterally to the armpits and down to the border of the ribs. The eyes were totally closed. The lower jaw could not be distinguished and in front of the ears, the skin stood off in large folds. The soldier suffered severe attacks of suffocation and breathing was very difficult, he was dark blue, and had a very rapid pulse. When I cut through the emphysematous tissue, which was about five to six centimeters in thickness, the breathing improved. On laying the larynx bare, I found that the right side of the cartilage was perforated and the flap about one centimeter square indented the larynx. Pulling outward of the flap with a stitch and tracheotomy was all I did. There was no point of exit on the left side of larynx, and the soldier must have coughed out the

bullet The next day the emphysema was much smaller and he could open his eyes Two days afterward I removed the cannula Four days afterward I sent him back to the hospital with good breathing, a weak voice, but a normal temperature. That breathing before the operation was so difficult was due to the fact that the emphysema produced a great deal of pressure upon the little flap of cartilage in the larynx and acted as an obstruction This flap acted like a valve and in that way the large emphysema was produced The difficulty in breathing had already benefited when the pressure was relieved through the incision

A third case was that of a soldier in whom the bullet entered three centimeters to the right of the larynx and in coming out produced, on the left side, a tear in the skin like a groove running up to the border of the lower jaw The injury must have been received while the man was lying with his head on the side, aiming We found him four days after the injury The small point of entrance was soiled and air passed through the opening while he was breathing weakly There was no emphysema His voice was very weak, and he had great difficulty in swallowing Above the jugulum I found an edematous condition of the subcutaneous tissue and in the depth there was pus We applied rubber tube drainage leading the tube out at the point of entrance of the bullet. The next day the temperature was normal Four days afterward the wound cleared up the voice was good, there was no pain and the patient could turn his head In this instance I saved a patient from mediastinitis by operating on the battlefield

I was not quite so fortunate in a gunshot wound of the larynx which I once observed in the case of a suicide in whom the bullet entered on the left side but there was no point of exit There was emphysema on the left cheek, and the patient had difficulty in breathing, and cyanosis On the left side of the pharynx wall, there was a point of exit Tracheotomy and gastrostomy were performed, but the next day the patient had a chill and died Eight days afterward post-mortem showed septic mediastinitis and

emphysema on the right side The bullet was in the fourth vertebra, having been located through roentgenization before the operation

The last gunshot wound in the larynx which I observed, came to me two hours after the injury. He showed a small point of entrance half a centimeter from the middle line in the line of the incisura thyroidea and a large exit in the posterior axillary line on the right side He was coughing up considerable blood In clearing the throat, a foamy bright red blood was expectorated; therefore, there must have been an injury of the larynx There was emphysema on the right fossa supraclavicularis and around the point of entrance The voice was only slightly weaker and there was not much difficulty in breathing There was strong crepitation in the neighborhood of the scapula and no exudate of the plura a very bad general condition, weak pulse of 120, cool extremities, straining at stool, yawning, and great restlessness We wrapped him in warm blankets and gave him morphine We prepared for tracheotomy in case he should begin to breathe with difficulty Three hours later he died without any symptoms from the larynx Post-mortem showed the entrance into larynx small on the left side to the incisura thyroidea The exit was on the right side between the larynx and the first ring of the trachea The right lower horn of the cartilage was broken The entrance inside was to the left of the false vocal chord, the exit between the false and the real vocal chord in the middle of the Morgagni pocket The openings into the mucosa were very small and not much torn In the larynx was foamy mucus The jugularis, carotis, vagus phrenicus, and recurrens were not injured The tissue all around the right side of the trachea was suffused with blood The clavicle was broken in the middle the second and third ribs fractured, the glenoidal part of the joint was broken to pieces, but the head of the humerus and the nerves were not injured The third rib had perforated the lung but there was no severe bleeding in the plural cavity There were considerable adhesions occupying a space as large as the surface of a hand in this region The muscle of the heart was strong and the heart normal

The injury of the larynx had also led to an emphysema, but it was not shown in the neighborhood of the injury of the lung and there was little difficulty in breathing during life. Although the bullet had passed between the vocal chords, none of them was injured and the voice was not very much impaired. The loss of blood was not too severe. The heart was strong, and no vital organ was injured. Was it shock that killed the patient? Possibly.

On the battlefield I found a dead soldier who had a defect about the size of a mark-piece on the front of his larynx, but no other injury. The injury seemed to have caused the man's death in a short time.

Two cases of injury from gunshot wounds in the upper part of the trachea and larger defects of the tracheal cartilage which were visible from the outside showed difficulty in breathing, but were not fatal. Since we had to move our first-aid station immediately after they came in, I lost track of these cases and could not make a prophylactic tracheotomy, as on the same day I had to take care of 800 wounded soldiers.

In another instance the bullet had passed five centimeters to the left of the middle line and in the height of the second tracheal ring, through the neck, and on to the other side just about as far from the middle line. It then turned outward and struck the clavicle and the right shoulder, causing a groove in the skin. The man coughed foamy blood, had a hoarse voice, some difficulty in breathing, and emphysema, but morphium and rest improved his condition in 24 hours, and he immediately recovered.

The first two cases were brought to me shortly after the injury and would surely have died without interference. The reason that we do not see severe injuries of the larynx is that the patients die before they get to us. Cases 5 and 6 show that these gunshot wound cases sometimes die through shock, even without injury to vital organs. The infection in Case 4 was in all probability due to the injury to the œsophagus, but I have seen another gunshot wound through the upper œsophagus which healed beautifully since we did not give the patient anything to eat or to drink. Case 7 shows that the larynx alone can produce a descending phlegmon. I never have had in a large number of injuries an œdema of the glottis. Dyspnoea and coughing up of blood were always the most prominent symptoms. Emphysema was always present except in Case 3 and might have disappeared in this case since he came into observation four days after his injury.

In all cases of gunshot wounds to the larynx and trachea in which great difficulty in breathing and a very extensive emphysema are present, an immediate tracheotomy is indicated, especially if the wounded have to be transported for two or three days in common wagons on poor roads and cannot have physician's aid during this time. However, if the point of entrance in the cartilage and into the mucous membrane is small a small dose of morphium and rest will bring about rapid improvement in the breathing. However, I have had to do tracheotomies many times on the battlefield in cases of injuries of the lower jaw and the falling back (swallowing) of the tongue for similar symptoms.

MILITARY SURGERY

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THIS paper is a short review of what I have seen as Consulting Surgeon of the French General Headquarters, sent in succession to all the firing lines from Belgium to Epinal. Some of the time was spent in the base hospitals, but most of it in the first aid hospitals at the front. The duties in the different zones may be briefly described as follows. In the first zone, nearest to the firing line, the lives of the patients are saved, in the second, limbs are saved and, in the third, reparative operations are performed. But the three zones are very different in importance: what is done in the first reacts directly on the results obtained in the two others. Therefore it is necessary to have surgeons of the first rank at the front.

I. GENERAL CONSIDERATIONS

The projectiles in use at present are not humane. The shrapnel and shells are murderous. The German rifle bullets are not of the same material throughout, the outer covering is hard and when it comes in contact with bone it breaks and the nucleus of lead which it contains often leaves a long track of metal behind it. The severity of the wound is proportionate to the distance from which the bullet is fired, a bullet fired from less than 400 meters causes tremendous destruction which is not proportionate to its volume or rapidity but depends often on the tissues with which it comes in contact. If it strikes a bone it breaks it into numerous large fragments and there is an enormous wound at the place of exit. Sometimes we see holes as large as a fist where a bullet has come out, or even a whole upper jaw carried away, as was the case with a general whom I cared for. This would lead us to believe that they use a special explosive or dum dum bullet, especially if such were found in the rifle magazine or cartridge belt of the soldiers. I have never seen this, but I have often seen bullets turned base forward intended to be fired at close range and thus cause serious

wounds. This explains the absence of a hard jacket on the base of the German bullet.

Injuries increase in gravity depending on whether they are made with rifle bullet, shrapnel, or bursting shells. The latter are particularly serious. The great majority of cases of tetanus and gaseous gangrene is due to them. The reason is that the fragment of shell always carries with it deep into the tissues bits of clothing covered with dirt which is always septic and which contaminates the tissues without allowing of evacuation of septic products, and which cannot be reached by any antiseptic or lavage. From this we must draw the conclusion that if a wound made by a bursting shell is large enough to permit of access to the bottom of it, immediate extirpation should be performed. This is the advice that I have always given to the surgeons at the front.

It is important to know what areas are most frequently affected. Statistics from the operative zone of the different armies have shown that death on the battlefield is most frequently due to injuries of the skull or the middle or upper region of the thorax. Abdominal wounds come next.

The patients brought in by the ambulance most frequently have injuries of the limbs and all of these may be considered infected. This is one of the facts that has been most definitely determined in all the zones of the Sanitary Service at the front immediately back of the trenches in the field hospitals and in the base hospitals. It is a curious fact that during the first few months of the war we found wounds of the soft parts that were benign and non infected but now infection is the rule and the dominant point in surgical therapeutics is the treatment of infection of wounds.

Unfortunately this question has not made any progress either in civil or military surgery and we are just as poor in efficacious methods as we were at the beginning of hostilities.

Every surgeon has his favorite antiseptic, and they are all of the same value or nearly so. This is easy to understand, for all progress in modern surgery is due solely to *prevention* of infection. On the contrary when this infection is once established we are as helpless in combating it today as we were forty years ago.

We have two methods at our disposal for combatting infection of wounds: general serotherapy and local antiseptics. We have tried both Antistreptococcic, antistaphylococcic, and polyvalent serums have not given any results. Antitetanus serum alone seems to have freed us from tetanus. I observed 120 cases of tetanus in all during the first few months of the war, and I have not seen a single case for months.

Have we a local antiseptic? There is none which really deserves this name. Whether we make use of tincture of iodine, dilute carbolic acid, sodium hypochlorite, hydrogen peroxide, or mercuric iodide, the result is the same, the suppuration continues. There is not at the present time any chemical product capable of suppressing infectious germs in the depths of a wound, and I do not know of a single example of a septic wound that has stopped suppurating as the result of the action of any chemical product whatever, applied to the wound or injected into the tissues. Each surgeon has his antiseptic formula. I have met surgeons in a number of ambulances and hospitals, each of whom boasted of his product, but on looking into the matter closely I have always found that their success was due to the *extremely attentive care* that they gave to the wounded, rather than to the product they used. A desire to demonstrate the superiority of their antiseptic led them to change the dressings more frequently and apply them more carefully.

This question chief in importance, of the treatment of infected wounds necessitates a knowledge of the pathological physiology of wounds. At best we only know that the microbic flora of wounds is *extremely rich* in both aerobes and anaerobes.

At the meeting organized by Crile in March at the American Ambulance in Paris, and at the English Society of Medicine at Rouen,

Wright, Carrel, and myself tried to solve the question. Wright tried to lift the veil and to show that there were causes furthering the vitality of the microbes in the products of wound secretion. The best method of neutralizing them was to arouse exosmosis by the application of a saline solution.

To neutralize a septic wound, it is necessary to find a substance that is bactericidal and not cytolytic. Carrel is carrying on research in this direction now, as we cannot neutralize the poison at present, but can only, as always, cause it to be absorbed or discharged. The application of gauze to the surface of the wound, a layer of hygroscopic cotton, and a bandage constitute the classical absorbent dressing that is used everywhere. It is possible to do better, however, and at present we practice continuous irrigation by the drop method with hypertonic salt solution by means of a simple device, which causes the liquid to traverse the wound. Despairing of finding a chemical antiseptic, we have returned to physical antiseptics: hot air and heliotherapy without dressing. These last two methods have given us remarkable results. A single surgical truth which has undergone the test of time remains fixed, that is the *drainage of Chassaignac* applied according to his principles, and with or without incision. The English surgeons were not far from the truth in taking as a maxim the saying which Godlee upheld: "Back to Lister." I must add as a matter of justice: "Back to Chassaignac."

In conclusion, immobilization and drainage are the true principles. Immobilization in fractures should be accomplished by means of plaster casts with handles.

Wounds in general may be divided into three great classes: simple wounds, anfractuous wounds, and gangrenous wounds.

For simple wounds the treatment is mechanical irrigation with hot water and the application of an absorbent dressing.

For anfractuous and irregular wounds in cision, the same treatment is followed as for simple wounds. An important point is not to make the wound bleed during the dressings.

There are three forms of gangrenous wounds that may be met with:



Fig. 1 Apparatus for the forearm

1 A simple local gangrene around the wound, this demands simple dressing while waiting for the formation of an eschar, or amputation above the gangrene. Freezing of the feet, really a gangrene, was a veritable scourge in November and December, and its victims were numbered by thousands. One fact, already pointed out in Manchuria and perhaps by Larrey, deserves special mention. That is "trench disease." I designate by this name trophic disturbances which may go as far as total gangrene of the fore part of the foot, and which is observed only in soldiers who have stayed in the trenches, it is due to humidity combined with slight cold. The temperature was not below 6 above zero and there was neither snow nor ice. It was first noticed among the Algerian sharpshooters in October by the physicians in the trenches, it was characterized first by a painful oedema, then an erythema and blebs on the dorsal surface of the foot, finally by cutaneous and deep gangrene. It receded as soon as the hygienic conditions were improved.

2 Gaseous gangrene, which in itself presents varieties that have a different prognosis and demand an entirely different treatment, depending on the cases.

a Wounds with gas around the wound making a veritable gaseous phlegmon. These yield to simple incision with a bistouri, irrigation, and a hot moist dressing, well dried

b. Acute gaseous gangrene, the "bronzed phlegmon of Velpeau," which has already extended to the greater part of a limb, demands incision with the cautery or deep cauterization at points three or four centimeters from each other throughout the whole zone affected. This method gives good results, as does also injections of hydrogen peroxide, but on condition that the gas is located only in the subcutaneous tissues.

3 Fulminating gangrene which, within a few hours, affects the entire limb, and against which even amputation, the only treatment, is often powerless. It is probable that in this latter variety there is a special microbic flora, and probably an efficacious serum will be devised against it. *Perfringens* is one of the agents but it is not very probable that it is the only one, and moreover the fact that it exists in almost all wounds without gangrene would make it necessary for it to be absorbed or associated under peculiar conditions in order to play a preponderating part in these affections. At present it should be known that all these forms of gangrene are dependent on the presence of a foreign body, which must be removed, as it is the source of the condition. Serotherapy has not given any results.

There is also a curious variety of gangrene that I met with at the beginning of the war in the Vosges in an ambulance at the firing line of Rambervillers where I was with the Physician General Chavasse. It was an ascending gangrene without gas, progressing slowly, starting from a wound in the hand and foot and mounting slowly to the middle of the arm or leg. My first case was that of a wounded Frenchman, struck by a bullet which had passed through his wrist. He had remained five days in a wood into which the artillery fire prevented anyone from entering, without any help and without any other dressing than the individual dressing which he had applied himself. The gangrene, which was a black gangrene without any considerable increase in the size of the arm and slightly humid, kept mounting until it reached the deltoid region and necessitated amputation. The same day a German soldier was brought to me with a gangrene of exactly the



Fig 2 Apparatus for the hand (fracture of the index finger)

same kind which had advanced to the middle of the leg. He came from the same wood, where he had been injured by a bullet that had traversed the region of the astragalus, and he had been there five and a half days without any other care than his own individual dressing. His leg was amputated by one of our German colleagues who was a prisoner. Both of them had lived only on bread, thrown hastily to them by soldiers on one side or the other when they passed near them.

There remains for discussion the general course to be pursued in dealing with foreign bodies. It seems to me simple enough, they should be localized by X-rays, and their removal should depend on the symptoms or the degree of trouble they are producing. Their localization is particularly difficult in the region of the muscles of the shoulder and thigh. The directing needle of the Contremoulins method is indispensable in these difficult cases. The vibrator of Bergonié which vibrates over the foreign body, gives remarkable results, and the electromagnet is used, especially at the American Hospital, for the removal of fragments of shells.

II INJURIES OF SPECIAL REGIONS

We will take up now surgery of the different regions.

Injuries of the skull, so frequently fatal on the battlefield may nevertheless recover spontaneously under conditions where this would seem most improbable. I have seen the brain traversed in all directions, from in front backward laterally and from above downward, without the patients showing any symptoms. I have seen a number of pa-



Fig 3 Apparatus for the leg. All the median part represents the tibia laid bare and fractured at several points. The wound extends from the knee to the tibio tarsal joint.

tients who had lost an amount of brain matter certainly as large as an orange, on the right as well as on the left, and in both frontal and occipital regions, who did not show any special symptoms. These cases however, are curiosities. The treatment of injuries of the skull at present is as follows. Excision of the soft parts, extirpation of fragments of bone, and drainage without touching the foreign body at first. I estimate that at present we are getting 50 per cent of recoveries, but we must be reserved as to the final prognosis, for many of these patients die months afterward. In any case, immobilization of the patient as long as possible after a trephine is imperative. It is more dangerous to move a trephined patient several kilometers than it is to let him traverse that distance without a trephination.

The course to be followed is more difficult when there are symptoms of localization without any apparent fracture of the skull. In this case a trephine should always be done. It will reveal one of two things, either a fracture of the internal table with fragments of bone in the brain, or a subdural hæmatoma without fracture. Lumbar puncture, on which I have so often insisted, is then a good means of diagnosis.

I will mention in conclusion numerous cases of traumatic shock in the form of annihilation of cerebral functions, paraplegia, continued delirium, and of catalepsy.

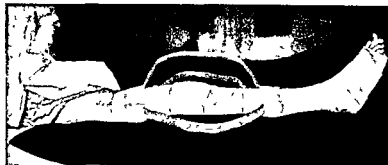


Fig 4 Apparatus for the leg showing wire frame in place

a number of cases which I have known to persist for a long time. They are almost always due to the bursting of a shell near the patient and are symptomatic of central lesions or of a preceding neuropathic condition. These examples of shock are abundant, for example the case of a colonel of artillery, whom I saw wounded south of Saint-Dié. A large shell burst at his feet and he disappeared under a mass of earth torn up by the projectile. We thought that he was crushed. He was found at a point 300 meters from where he had been wounded, his clothes were torn off, he was livid, pulseless absolutely cold and apparently moribund covered with débris, and bleeding. He was picked up undressed, the dirt washed from his skin, and artificial serum and camphorated oil injected. Little by little we found out that there was nothing the matter with him except multiple scratches and a little wound of the soft parts of the forearm. He was warmed, and two hours afterward he was conscious and had a very good pulse, the next day he got up. I could tell of numerous similar cases.

These distant nerve lesions are also observed in certain bullet wounds of the face. I saw four very clear cases in which a bullet traversed the face without touching the orbit or the optic nerve and either one or both eyes were affected with retinal hemorrhage, or a slight detachment of the retina.

Fractures of the maxilla are frequent and severe. Their treatment has made considerable progress since we have given it over to the dentists. Continuous lavage and

bridges have given us therapeutic results of which we were ignorant before. The treatment lasts for months but this is not too much to pay for the results.

Injuries of the spinal cord are much more serious. I have never seen in my own service or in any of the medical services at the front, all of which I have examined during the past eight months, a single case of recovery or even of survival for a long period after complete section of the cord. We may give as a fixed rule that the wounded succumb before the twentieth day, and the higher the wound is the quicker they die. On the contrary, incomplete, lateral wounds often allow of an indefinite survival, leaving a local sequela.

Injuries of the lateral part of the thorax generally heal absolutely like simple wounds, immobilization of the patient is the only condition to be fulfilled. But I should call attention to three facts.

- 1 To leave a foreign body is always serious for it is rarely that it does not give rise to suppuration ultimately.

- 2 When the injury of the chest is accompanied by hemothorax, recovery is always extremely slow, it may be prolonged for weeks or even months and during all this time slight febrile attacks may alternate with apyrexia, without suppuration taking place. Of course the latter necessitates a thoracotomy with resection of the ribs, injection of oxygen, and exercise of the lungs.

- 3 Successive punctures are necessary in these cases to relieve the patient, they give very curious results. I have seen a number



Fig 5 Apparatus for leg completed. All the part situated below this line will be compressed when the plaster is dry. The parts of the apparatus may be too far apart and they may be brought closer together with just as much solidity by using a simple hoop.

of effusions which looked absolutely like repeated secondary hæmorrhages. The first puncture made after a month produced an absolutely red liquid. Seven days later another puncture gave the same quantity of liquid of the same color, and so on for six weeks. We were justified in thinking of a repeated hemothorax. Very much puzzled by these facts I analyzed them very closely and saw that it was not a hæmorrhage at all, for the liquid withdrawn at each puncture did not coagulate, even in the 24 hours following. Microscopically it did not have the composition of blood at all and only contained a small number of red corpuscles. It was a serous effusion colored by the blood that had been effused previously. I studied with Milian all the pathological physiology of these cases.

Secondary hæmorrhages in injuries of the lung are rare. I have had only two cases which I reported to the Surgical Society.

Injuries of the heart are very rarely seen. I reported to the Surgical Society the history of a French prisoner in Germany who, perfectly normal before his injury, was struck by a bullet which entered a centimeter from the left edge of the sternum and came out behind at the eighth left intercostal space. He presented after that, and still presents, all the signs of a serious loss of substance of the mitral valve.

There remains the always important question of wounds of the abdomen. It is one of the questions on which I count on seeing a great deal of progress in the present war. From the very first I took a personal interest

in these cases. I took up patients at the front with penetrating injuries of the abdomen and transported them in automobiles to a neighboring hospital 10 kilometers from the firing line near Epinal, where I performed laparotomy. My results were bad; all the patients with injuries of the small intestine died. The question at present is to find out whether laparotomy is capable of giving satisfactory results in injuries of the small intestine.

We must distinguish carefully in these cases between hæmorrhages into the peritoneum, injuries of the large intestine and those of the small intestine.

In the very numerous medical reports which I have read in the course of my inquiries among the physicians of the armies and of the ambulances at the front, the conclusion has been the same, that is that patients almost always die after laparotomy when there is a wound of the small intestine. I estimate that thus far in the whole French army there are not so many as twenty wounds of the small intestine which have recovered after operation. But simple wounds of the peritoneum and those of the large intestine give very numerous favorable results. Let us look at the matter a little more in detail.

The three methods are laparotomy with exploration of all the intestine, suprapubic incision or expectant treatment. When the material conditions, operating room, rooms for the patients and personnel permit it, when they are in charge of a skilled surgeon and when the patient is brought in in time and in reasonable general condition, laparot-



Fig 6 Radiograph of patient showing enormous projectile, a cartridge of a Lebel rifle

omy remains the method of choice, but these conditions are rarely fulfilled. The Health Service in France has made great progress in reference to equipment, and movable operating rooms are installed at different points along the front, where all the conditions demanded in surgery in times of peace can be complied with.

Suprapubic incision is indicated when there is an abdominal effusion or where a peritonitis has developed and a laparotomy cannot be risked. The statistics given for this operation should be judged with some caution, for they profit by all the cases in which there have been no wounds of the intestine or where there has been simply a hemorrhage into the peritoneum. Therefore if we wish to compare the results of the two operations, we must accept for the latter only those cases which have been followed by a fistula of the intestine. I have shown that these cases are exceptional.

In all cases, drainage and the sitting position are imperative. Expectant treatment is a last resort, but it has good results in countless cases. For my part I have seen abdominal injuries, including one at the eighth left intercostal space and three of fecal fistula that

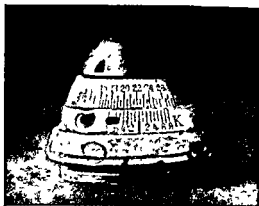


Fig 7 Head of shell. The median line shows the distance from which it has been fired and which makes it possible to regulate the range

recovered perfectly. In all cases where asepsis cannot be realized or where material or personnel is insufficient, recourse must be had to withdrawing food, immobilizing the patient in the sitting position, applying ice, and giving opium and subcutaneous injections of serum.

Injuries of the kidney are rare and not particularly serious. At Auxiliary Hospital No. 20 at Saint-Germain-en-Laye, I performed two late partial nephrectomies for urinary fistulae due to lesions of the parenchyma of the gland, both recovered perfectly. I had to perform a total nephrectomy for a bullet wound of the kidney pelvis with encysted effusion, which I had previously opened.

Surgery of fractures, which had been so much neglected, has taken first rank in military surgery, because of its great frequency and because of the capital importance of its results to the wounded.

In surgery of the limbs two great principles dominate the treatment: every fracture is infected and every compound fracture should be completely immobilized.

Wounds of the tissues by bullets may unite without suppuration, and therefore it is not necessary to incise and tampon them all, but the great majority suppurate and must be drained. This brings up the question of the conservation of the limbs and the best method of accomplishing it.

The hand and foot, more or less shattered by projectiles, should be preserved at any cost. I know too well the ineffectiveness of all artificial substitutes, particularly of the arm and hand, even to permit an amputation unless it is absolutely justified by the certainty that if it is not performed the patient will lose his life. Experience has shown me that the most scrupulous care, carried out in the most minute detail and perseveringly over long periods of time, will bring about conservations that one would have thought impossible and which justify us in always hoping. It is these cases of conservation that have given the most satisfaction to my surgical conscience. I consider amputation indicated only when I am convinced that without it the life of the patient is irremediably lost and that within a very short time. To put the thought in a paradoxical form I would say that the conservation of the limb has no limit except the patience and skill of the surgeon. Drainage, irrigation of the wound, cauterization if necessary, and, first and foremost, absolute immobilization of the two segments of the limb will lead to almost unhoped for recoveries in the great majority of cases.

I present herewith photographs of the apparatus which has given me unhoped for success, it is superior to all others that I have used. It must be watched; it demands time, but it insures idleness, that is to say rest and sleep, it makes dressing easier and less painful, and gives the greatest chances of recovery without septic complications. It is, as you see, a plaster cast provided with a framework of iron wire. I did not devise it, but I am a very ardent advocate of its use. It is made as follows:

Over the points of support, that is, the malleoli of the tibia and fibula and the internal and external condyles of the tibia, two small tampons of cotton should be placed, or better still, little rubber sacs filled with air, to protect the points of support. A flannel bandage is then wound around the whole limb to protect the skin.

This done, there are two ways of proceeding. On the leg for example, a malleolar segment is applied and a tibial segment coming up to just below the knee, without compressing it. The fracture is reduced by flexion, and during this time the strip of metal that has been bent and prepared

in advance, is placed between the two. A plaster band is placed around the juncture of the cast, and the metal, or better still a little oakum, is dipped into the liquid plaster and applied directly to the juncture of the metal part and the non-plastered part of the apparatus, this hardens and makes an excellent suture. With practice one can learn to make a very light and absolutely firm apparatus. Its firmness can be judged by taking the apparatus by the metal strip and moving the limb in all directions, there should not be the slightest sign of mobility.

It is very easy to make in this way an apparatus for progressive extension. In place of one metal brace two are used, corresponding exactly to each other and united in the median line by a screw. Loosening this screw moves the two segments of metal away from each other and thus brings about a true progressive extension. This latter improvement has only a few applications.

The question of apparatus is very much discussed. I leave aside the question of compound fractures of the leg, the fore-arm, and the arm. Immobilization in a good plaster cast or continuous extension in one of the innumerable forms of apparatus is sufficient for cure. Summing it up, first perfect immobilization and then coaptation is the line of treatment.

For the femur and the knee the question is much more difficult; account must be taken of the army zone in which the patient is located. At the front large zinc splints starting at the foot and coming up like a coxalgia apparatus, surrounding the limb which is covered with gauze, give sufficient immobilization and are the best apparatus under the conditions, but they are always inferior to a plaster cast well applied. This is the unanimous opinion of surgeons. But the difficulty of its application and the time it takes prevent it from coming into general use. In the second zone the plaster cast with handles is used. The results which it gives are absolute immobility of the wound, easy transportation, rapid dressing, and, consequently, rapid decrease if not disappearance of signs of infection. In the ambulances at the rear the best results are given by the Hamilton or Blake continuous extension or Tillot's simple apparatus.

But aside from the question of immobilization there is that of infection. In this respect unexpected results are given by in-

cision and drainage, leaving adherent bone fragments in position, and by continuous lavage, drop by drop with aspiration, as previously described. When the signs of infection have disappeared, then perfect reduction of the limb becomes the only care, but it must be remembered that suppuration and discharge, or extraction of fragments, may last for weeks or even months. During this long period of treatment, whatever limb is fractured, the most careful watch must be kept over the joints above and below the fracture, and they must be given the necessary movement, for there have been thousands of cases of stubborn stiffness of joints, very difficult to overcome and due solely to a too prolonged immobilization, often in a bad position. This mobilization should be accomplished by the patient's muscles themselves, not by mechanotherapy.

Amputation is only justified to save the patient's life, and we must have extreme patience with reference to infections, for they are often overcome after many weeks of septicemia. The site of the amputation should also be selected carefully. Parts of the limb are sacrificed too willingly. Amputation should be performed as far as possible within the zone of the injury, simply leveling off the bone surface. I believe in this line of conduct because of the results of more than a thousand amputations which I examined at the *Maison Blanche*. There is a great difference between the results of an amputation of a leg near the middle third which gives good results, and one at the upper third, which permits of walking only on the knee. Worse still is amputation of the femur which leaves the patient absolutely infirm. Certain operations should be given up.

The examination of these thousand patients led me also to a curious conclusion and one which justifies what I said above in regard to infection. At present more than 60 per cent of the patients who have had amputations performed have had to give up their limbs a long time after the injury, not because of the extent of the wound, but because of a subsequent infection.

In injuries of the knee, aspiration by Carrel's method or continuous irrigation give

good results, nevertheless suppurative arthritis with ankylosis is the rule in all cases where purulence of the knee leads to a reactive fever. Still it is not necessary to be hasty in amputation. Resection of the knee has given me remarkable results in these cases. As to foreign bodies in the joint, they should be removed immediately.

To finish this question I should mention that 8,000 of our patients who have had amputations performed have not yet been able to get artificial limbs of French manufacture, because the workmen are at the front and the raw material is lacking. We have been obliged to have recourse to the American factories to make up the enormous deficit produced by the conditions under which we find ourselves. In 1900 at the Exposition I had occasion to study this question as Reporter-General, and I made a comparative study of the apparatus all over the world. The question is most difficult with reference to the lower limbs. A good apparatus is one that is not too painful, but it necessitates a good stump, which is rather rare under the present conditions. As to the apparatus itself, it should be constructed primarily with reference to the work of the patient and the use he is to make of it.

Vascular lesions are frequent and present themselves under three forms: immediate or late hemorrhage necessitating ligation, interstitial hemorrhage veritable aneurisms, which may become evident soon or late, and necessitate placing a catgut on the two extremities of the artery in the wound, and secondary hemorrhage which necessitates ligation in the wound if it is aseptic and accessible, but if it is gangrenous or inaccessible, ligation in healthy tissue or beyond the wound. These ligatures are very benign and, except in aneurisms, are not followed by gangrene. I have ligated in this way all the large arteries, even to the subclavian inside the scaleni.

We will know later what is to be expected from surgery of the nerves. Two kinds of cases are presented. The nerve-trunk may be caught in a scar or callus. Freeing it from cicatricial tissue gives results that are often immediately favorable. But it is dif-

ferent with nerves that have been sectioned and sutured. Electrical examination during the operation is imperative. Only obliterating fibrous neurones should be resected. Suture should be with Carrel's thread. The operations have been performed too recently to know the results. In certain regions, such as the plexuses, I am convinced that suture should be performed immediately as soon as the lesion is recognized, and for the following reason. I operated late in a large number of these cases and I found a compact mass enveloping all the nerves, in which it was impossible to distinguish the branches that had been injured, and so of course I could not suture them. It would have been very different if I had operated soon after the injury.

During this war the most extraordinary injuries have occurred without causing any trouble. I have been shown bullet wounds that traversed the sternum from in front backward, laterally, and from above downward, without having caused serious symptoms. I have seen the thorax traversed laterally, from above downward, from the shoulder to the diaphragm on the right side and to the left axillary region, without any inconvenience to the patients.

I leave out of account these extraordinary cases, but I wish to cite three particularly suggestive cases. The first is in regard to the head of a shell, which is shown herewith (see Fig. 7) and which was extracted from the skull of an Algerian sharpshooter. It enables us to regulate the range of our artillery by looking at the inscription on the shell which shows from what distance it had been fired.

The second is in reference to a wound by an incendiary projectile which exploded at every dressing. (See Case 2. I could not, unfortunately, furnish you a photograph of this shell, which I presented to the Surgical Society.)

The third is that of a French cartridge that had penetrated the brain of a wounded Frenchman. I cite the latter because it will give you an idea of the customs of this trench war (see Fig. 6, Case 3).

The transportation of the wounded re-

mains to be discussed. In the beginning of the war when we were overwhelmed by numbers, transportation was defective. The patients were heaped into merchandise wagons and carried as far as possible into the interior of France, this was at the time of the retreat from Belgium. Little by little the service has improved, and at present I would divide it into two parts, the first from the moment when the man falls on the battlefield until he is put on a stretcher; the second from that moment until he enters the hospital. There is no improvement possible in the first part. The wounded must be looked for between the opposing lines at night and generally under the enemy's fire. They are then transported, either on the back of a stretcher carrier or held in his arms like a child, their bodies quivering and in the most deplorable and lamentable condition. Having been brought to the trenches they are carried out one by one generally seated in a chair, for a stretcher cannot turn in the narrow trenches. The distance to be traversed in this way varies from one hundred to six or eight hundred meters, and is the most painful part of the transportation.

As soon as they are on a stretcher they are dressed with an individual dressing — often a better dressing is put on at the dressing station — and then they are placed in an automobile ambulance. These are the carnages which give the greatest service, they come up as near as possible to the firing line, for they can carry the wounded away rapidly and comfortably to a hospital or railway station. There they are divided into two classes: those who can travel are placed immediately in trains where they are installed comfortably and carried away to the interior of France, the others are kept in the hospitals near the firing line. The latter class includes the injuries of the abdomen, injuries of the thorax, of the skull, fractures of the femur, especially the upper third, and all hemorrhages.

All these posts demand skilled surgeons, the number available is certainly insufficient, for among our 16,000 physicians, more than 1,500 of whom are already incapacitated for work, there is only a limited number of

surgeons. The system in use at present supplements this number. It consists in having in a Sanitary group one surgeon who decides on the indications for operation, and who places a restraint on those too hasty amputations that were seen in the beginning of the war. He is aided by a number of operating surgeons, and, thanks to this system, a single experienced surgeon may take care of several hundred wounded a day.

This improvement, which seems very simple, was very difficult to bring about, but it has produced the best results for it is true that, to carry out an operation correctly, a few months' study is sufficient, while to decide on the indications for operation one should have a surgical experience of years.

CASE 2 An Alpine chasseur wounded near Poperinghe by an incendiary shell had a fracture of the leg and a wound of the arm. When the wound was being dressed, and while they were removing the gauze that had been applied immediately after the injury, there was a small explosion with a flame, an explosion resembling the popping of a match, or rather of a firecracker accompanied by a small puff of smoke with a strong phosphorus odor. While the wound was being cleansed with a tampon of hydrogen peroxide there was a series of little explosions lasting for about 30 seconds, all giving off a little smoke with the same phosphorus odor. Then the explosions stopped but the odor persisted and the wound was examined. The whole limb showed considerable swelling and the tissues were black as if covered with soot.

Very much astonished by these phenomena, which he had confirmed by all around him, the physician renewed the dressing the next day and there was again a series of crepitations with the production of a little smoke with a phosphorus odor. On the following days when the dressings were applied there were renewed crepitations and renewed vapors which always had the same odor of phosphorus. The patient died of phosphorus poisoning.

At the second dressing the wound was incised and the surgeon removed from the muscular mass a

fragment the size of a nut composed of a tube of rose-colored celluloid, two millimeters thick, and a mass of paraffin, all of which took fire from the slightest spark.

These fragments, examined by a technical committee from the artillery, were found to be made up of celluloid, paraffin, and lead oxide.

Physiological examination by the Faculty of Sciences of the University of Paris did not show phosphorous intoxication, which, however, does not prove anything.

This was therefore a wound by an inflammable shell containing phosphorus, which caused death by phosphorus poisoning.

CASE 3 A soldier, M., of an African battalion, injured at Somme, by a shell which burst near him, presented several injuries, one of them a fistulous wound at the internal angle of the left eye, a lesion that was apparently insignificant. The eye seemed normal, but the vision was somewhat disturbed. On looking closely there was found to be a slight erosion of the conjunctiva and a fistulous tract which discharged a little pus at the internal angle of the eye. The temperature rose, the patient complained very much of his eye and vision grew worse. At the internal angle of the eye abundant suppuration was found. It was decided to make a radiograph to find out whether a foreign body had penetrated the orbital region. This radiograph showed the presence of an enormous projectile, a complete cartridge of a Lebel rifle, which would not have been suspected at all from the entrance wound. The temperature continued to rise and the patient had a pronounced delirium. He was operated upon as soon as possible. It was seen that the eye was lost, there was a tolerably extensive lesion of the sclerotic, a burn produced by the hot projectile, followed by a scar, and by discharge of the vitreous body and panophthalmia. The eye being removed, we could see clearly the bottom of the cartridge embedded in the internal part of the orbit. After tolerably vigorous efforts the cartridge was extracted entire. Pus escaped through the gaping wound and a drain was placed in the track of the projectile. The patient died two days later. On autopsy the whole surface of the brain was found covered with an abundant layer of pus. The projectile had traversed the internal wall of the left orbit, the ethmoid, the sphenoid sinus and had pierced the anterior part of the right temporal fossa on the external wall of the cavernous sinus.

THE CAUSE OF TUBAL PREGNANCY AND THE FATE OF THE INCLOSED OVUM

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THE following report is based upon the study of 117 specimens of tubal pregnancy which have been collected during the past 17 years. A detailed account of these specimens will be presented in a well-illustrated monograph (No. 221), to be published by the Carnegie Institution of Washington.

CAUSE

A review of specimens, which is accompanied by data bearing upon the cause of tubal pregnancy, shows quite definitely that this condition is associated with inflammatory changes which must have preceded the lodgement of the ovum in the uterine tube. Under normal conditions the tube is lined with a layer of ciliated epithelium, which constantly works in the direction of the uterus and therefore creates in the tube a stream of fluid from the ovaries to the uterus. The fertilized ovum gets caught up by this stream and if the conditions are normal is carried into the uterus. Any change which delays the ovum in its progress will favor tubal pregnancy. It is well known that abnormal diverticula or duplicate tubes may be the cause of tubal pregnancy, and numerous isolated cases have been described in which a blind tube or large diverticulum contained the implanted ovum. In rare cases the blind inner end of the tube left after an operation is subsequently found to contain an ovum which has arisen from the ovary on the opposite side which contained the corpus luteum whereas only on the opposite side was there a passage free between the uterus and ovary. However, these anomalies are rare and cannot be viewed as the rule in cases of tubal pregnancy.

Much more commonly associated with tubal pregnancy is a chronic inflammation followed by adhesions and kinking of the tube. This has been repeatedly observed, but it is difficult to associate adhesions on the

outside of the tube with the arrest of an ovum within its lumen. Whenever histories of specimens are given, it is frequently stated that there were numerous adhesions binding together the pelvic organs. It is also stated that tubal pregnancy usually takes place in women who have given birth to a child and then have been sterile for a considerable period. This fact is well known to gynecologists, and they are inclined to believe that the occurrence of tubal pregnancy indicates that the inflammatory condition in the tube, which prevents pregnancy for a number of years, is gradually disappearing, so that if tubal pregnancy had not taken place the chances are that the tube would probably have become healed in a few years, thus permitting the fertilized ovum to reach the uterus. This theory receives strong support from the study of numerous cases of tubal pregnancy. If the ovum within the tube contains a normal embryo, there is but little adjacent inflammation, if it contains a pathological embryo, the changes in the tube wall are usually marked, and when the ovum is well disintegrated, the changes are still more pronounced. Read in the other way, this would mean that if the inflammatory condition is nearly healed, the ovum implants itself in the tube and grows normally, but if the results of infection are still pronounced, the ovum rapidly disintegrates. Such an inflammatory process is signalized not only by an inflammatory reaction in the tube wall, but also by very pronounced changes within the tube lumen, the most common of which is a condition known as follicular salpingitis. The tubal folds hypertrophy, their tips becoming adherent, and, when sections are made, small cavities are seen between the folds, hence the term "follicular." Often this process is so marked that a section of the tube shows the folds as an extensive and delicate reticulum permeating the entire tube.

lumen In such cases the individual meshes of the folds have projecting into them numerous fingerlike processes, reminding one very much of a section of the intestine While this process is at its height, it is clear that an ovum cannot pass through the tube, and much less can the spermatozoon pass outward to reach the ovum It is only after this process has abated somewhat that it is possible to have conditions suitable for the production of a tubal pregnancy.

Another type of change differs markedly from follicular salpingitis, but in a way seems to go hand in hand with it This condition may be spoken of as outpocketing of the epithelial lining. Here the muscular wall is thick and fibrous, and numerous small diverticula reach out into the muscular coat Sometimes these are markedly distended at their blind ends In other specimens they seem to run in parallel lines, indicating that instead of a single lumen we have numerous small lumina side by side Either of these conditions would account for the arrest of the ovum. The ovum is taken up by the mucous membrane of the outer end of the tube, and owing to the impairment of the ciliated cells is delayed in progress On account of this delay it grows too large to be carried through the narrow portion of the tube into the uterus This condition would be aggravated when the tube lumen is greatly reduced at the uterine end, so we can easily postulate two kinds of changes to account for the two kinds of implantation so frequently encountered When the ovum lodges at the outer end of the tube we should expect the outer end of the tube to be lined with fairly normal mucous membrane, but if the ovum is delayed in its progress and becomes too large to pass later through the uterine end of the tube we should expect to find the tube lumen reduced in size in this situation

A third type of implantation usually takes place in the middle of the tube, and is the most common variety In this type we most frequently encounter tubal inflammation and follicular salpingitis It seems as though the ciliated cells can carry the ovum to the middle of the tube, but no farther The ovum then implants itself within the folds of the tube,

and soon becoming too large for the space it started to occupy; through secondary rupture is cast into the tube lumen This process is always accompanied by considerable hemorrhage, with marked distention of the outer end of the tube In case the ovum is not aborted into the peritoneal cavity, it becomes larger and larger, it is encircled by a dense fibrous clot and disintegrates Often the entire tube wall, which is thin and inflamed, has practically disappeared.

I intentionally do not take up the question of the nature of the inflammation which appears about a tubal pregnancy It seems that, however, in certain instances this inflammation is due to the tightening up of an old infection that had occurred at the time of a previous labor, although the evidence points more toward venereal disease as a more usual etiological factor. The more frequent incidence of tubal pregnancy in cities than in country districts, and the frequent histories of gonorrhoea in these cases, point strongly toward the latter as the chief cause of tubal pregnancy I do not believe that the evidence we have now warrants a more definite statement than this, as the subject cannot be determined by the histological picture For the present, therefore, the question must still remain open

TUBAL PREGNANCIES CONTAINING NORMAL EMBRYOS

In case the ovum becomes well implanted within the middle of the tube and ruptures into the broad ligament, conditions are brought about which favor the development of a normal embryo Rupture on the free side of the tube would throw the embryo into the peritoneal cavity and therefore would probably terminate its life The same is true when the implantation takes place near the uterus Here the tube distends with difficulty The ovum burrows into its thick wall and usually passes right through into the peritoneal cavity I have numerous beautiful specimens illustrating this point

In studying the specimens of tubal pregnancy, I arranged them in three groups to correspond to their contents, namely, (1) whether they contained normal embryos,

(2) pathological embryos, and (3) pathological ova. Each group was then divided into two subgroups, marked "examined" and "unexamined" respectively. The specimens have been arranged in this way to facilitate the study of them statistically. When embryological specimens were first sent me, only normal ones from tubal pregnancies were included, and this accounts for the large percentage of normal ones in the first 500 of this collection. For statistical purposes, only those specimens marked "unexamined" should be compared. In these cases the specimens were not selected by the surgeons who performed the operations, so that during a period of 17 years I have obtained 13 normal embryos, 20 pathological embryos, 47 pathological ova, among 80 unexamined tubal pregnancies. Thus it will be seen that of the pregnancies which were not examined before the specimens were sent to this collection, 16 per cent, or nearly one-sixth of the whole number, contained normal embryos. I am rather of the opinion that this is too large a proportion, inasmuch as the small tubes containing a small ovum were generally not sent me.

It seems highly probable that when the ovum is normally implanted and contains a normal embryo, it is attached to the tube wall much as the ovum is attached to the uterus normally. It burrows through the mucous membrane and makes for itself a space between it and the muscular wall. This process is accompanied by a marked hemorrhage, probably much more pronounced than is usually the case for a uterine implantation. The trophoblast promptly attacks the venous sinuses of the tube, first growing around them and then into them, but there is no response in the tube similar to that which takes place in the uterus. In the tube, practically no decidua is formed, and as it seems that the decidua is an important factor in preventing extensive hemorrhage it follows that from the beginning the implanted ovum in the tube must be surrounded by an excess of blood. The blood which is in immediate apposition with the trophoblast does not coagulate and is taken up by the syncytium, which is usually very markedly vacuolated

and serves as pabulum for the ovum. All stages of destruction of the blood-corpuscles can be seen in suitable specimens. Particles of red cells are found within the cells of the trophoblast, where they still take on their characteristic stain. Soon these particles become so small that they blend with the protoplasm of the syncytium, giving to it the tone of the staining property of the red cells, so we can find all gradations and colors from red cells to the well-stained syncytium without demarking sharply the blood pabulum in its digestion by the trophoblast. If the hemorrhage is excessive the blood forms a clot, that is, the antibody produced by the trophoblast to prevent coagulation of blood acts only in its immediate vicinity and does not penetrate the larger mass of blood. This clot then becomes a foreign body and cannot serve further as pabulum for the ovum. As rapidly as the trophoblast punctures the venous sinuses of the tube it throws up a wall, so to speak, which prevents excessive hemorrhage into the intervillous spaces. If the blood dribbles in slowly, it seems to serve best as pabulum for the ovum. Extensive hemorrhages are prevented by the cells of the trophoblast, which soon change into vacuolated syncytium and thus seem to protect the intervillous spaces. The larger meshes in the syncytium take up groups of red corpuscles, which are held until they fragment and are taken up by the protoplasm in the process of digestion.

The trophoblast also has a marked tendency to produce a peculiar necrosis of the maternal tissues with which it comes in contact, producing the so called fibrinoid substance. Apparently this is formed primarily in the mesodermal tissue of the mother, but the fibrin of the blood, the epithelial cells, and the free trophoblast do not seem to escape in this form of necrosis. With the aid of the fibrinoid substance a strong wall is formed between the tips of the villi and the tissue of the tube. This mass then forms a line of demarcation between the ovum and the tube wall, even if the latter be ruptured. The implantation cavity then is lined with much fibrinoid tissue upon which are scattered cells of the trophoblast. Later these individual

cells penetrate the fibrinoid substance, giving it in older specimens the peculiar appearance of cartilage. Tips of the villi penetrate this wall, and from them streams of active trophoblast reach out and puncture fresh sinuses. In every respect the condition found in normal implantation in the tube seems to be identical with that found in the uterus except that there is no formation of decidua. As the decidua may be viewed mainly as an agent to prevent excessive hæmorrhage, it can be spared in the tube in case the trophoblast and fibrinoid substance take its place. In fact, in the latter part of pregnancy in the uterus the decidua does not seem to play any great rôle.

Altogether 43 normal specimens in this collection were obtained from tubal pregnancies. The youngest specimen contains an embryo 4 mm long, the oldest a fœtus 96 mm long. It is interesting to note that the larger number fall in the sixth week, that is, our surgeon usually make a diagnosis during the sixth week of tubal pregnancy. No doubt many of the normal embryos would not have continued as normal specimens, for instance, in one containing an embryo 4 mm long there already were pathological changes within the spinal cord. Others had ruptured and the embryo was found free within the abdominal cavity. Thus we could not expect many of these to survive through the full period of normal pregnancy. No doubt they would have succumbed in a variety of ways but in what percentage it is impossible to determine. Of all those that survive only one fifth remain normal, the rest become pathological or turn into monsters as shown by von Winckel's studies.

It is interesting to note the fate of 13 specimens, containing normal embryos, which were not examined before they were sent to me. No 808 was unruptured and contained what appeared to be a normal embryo, nevertheless upon careful examination after it had been cut into serial sections it was found that a small portion of the spinal cord showed marked histolytic changes. These were limited exactly to the part of the cord giving origin to the motor roots the dorsal part of the cord appearing to be normal throughout. No doubt had we examined all of the embryo os

TABLE I

List of 13 normal embryos that came to the laboratory without examination or selection before the specimens were sent

Cat No	Dimensions of Tubal Mass in mm.	Length of Embryo in mm	Remarks
808	70x25x125	4	Unruptured Histolysis of spinal cord.
706	55x15x15	6.5	Ruptured Menstrual age, 3 weeks
359		8	Aborted
611	30x30x30	8	Ruptured
507	20x10	9	Aborted
551	60x35x50	11	Unruptured. Tube wall nearly destroyed
670	55x30x25	11.5	Just ruptured
125		15	Ruptured Menstrual age 9 weeks
576	30x30x25	17	Unruptured.
431	60x45x15	19	Unruptured
657	35x20x15	25	Unruptured Menstrual age 3 weeks. Tube evenly distended. Embryo may be atrophic.
181		25	Aborting Tube evenly distended.
484	110x100x50	96	Unruptured Tube evenly distended

which appeared to be normal we should have found slight changes in different parts of the body of some of them.

It is seen by glancing at Table I that only the larger specimens are unruptured, showing that most of those containing younger embryos came to an end through rupture of the tube. The larger specimens (e.g., Nos 576, 431, 657, and 484) reached this stage of development because they did not rupture. In these the tube is evenly distended. In other words only 4 pregnancies among 117, or less than 4 per cent, have survived. Only these are suitable for development to full term. We must look to this group for the specimens which become markedly deformed toward the end of pregnancy. According to von Winckel four fifths of the fœtuses are markedly deformed. Therefore the probabilities are that of 117 specimens under discussion only 1 might reach maturity as a normal fœtus.

TUBAL PREGNANCY CONTAINING PATHOLOGICAL EMBRYOS

Whenever the degree of alteration in the tube wall is pronounced and accompanied with marked infection, the ovum does not

implant itself well, and consequently the embryo does not develop normally but becomes atrophic and degenerates. The more severe this process, the more pronounced is the reaction upon the ovum, or in case it begins to develop normally, excessive hemorrhage around the ovum detaches the chorion from the tube and strangulates the embryo within. It dies suddenly and shows no tendency to grow in an irregular fashion. Later it disintegrates.

The pathological changes found in the tube appear in most of the specimens I have studied. First, there are marked outpocketings of the epithelial lining of the tube, with a thickening of the muscular layer. This condition, according to the study of my specimens, appears to be chronic, as it is not accompanied with any leucocytic infiltration. Secondly, an acute condition, which is more frequently found, consists of an hypertrophy of the folds of the tube, which subsequently becomes adherent, thus forming numerous small pockets in the tube, known as follicular salpingitis. The mucous membrane is swollen and infiltrated with leucocytes and there is often an extensive exudate. According to Werth, this condition is usually associated with gonorrhœa, and there is nothing in the history of my specimens which speaks against this opinion. The inflammatory process is more marked in those cases containing pathological embryos than when they are normal. In practically all these cases the tube lumen is present sometimes as a large semilunar slit encircling the hemorrhagic ovum and sometimes as a simple tube on one side of it. It generally remains open throughout its course, showing that in them as well as those containing normal embryos, the implantation is interstitial. In general, the tube lumen is small at the site of the implantation and becomes larger on either side as the mass extends within and distends the tube lumen.

All of the specimens containing pathological embryos, whether examined or not before being sent to the laboratory, are arranged in Table II. I have also included specimens Nos 825 and 874, which were assigned to the group containing pathological ova, as well as No 808 from the group of normal embryos.

TABLE II

List of tubal pregnancies containing pathological embryos

Cat No	Dimensions of Tubal Mass in mm	Length of Embryos in mm	Form of Body	Character of Change in Embryos
815	90x10x15	0.1	Nodule	Mesenchyme containing a few epithelial cells
313	30x20x20	1	Irregular	Small remnant of a greatly deformed embryo at the end of a large umbilical cord
554	50x20x20	1	Nodule	
874	80x30x25	1	Fragment	Chorion very active
196	50x30x30	2.5	Greatly deformed	
306	40x28x20	2	Double vesicle	Tissues in active growth
374	45x45x45	3.5	Rounded	Path change in chorion
607	55x30x30	3	Small body	Completely dissociated—menstrual age 10 weeks
882	110x15x33	4		
808	70x25x25	4	Normal	Histolysis of ventral side of spinal cord in thoracic region
477		5	Irregular	Markedly dissociated—menstrual age 2 weeks
507	55x30x25	5	Atrophic	Dissociated
784	75x35x35	5	Dead tube ruptured	Dissociated organs cannot be outlined. Menstrual age 8 weeks.
838	27x23x20	6	Tube ruptured	Thoroughly dissociated central nervous system can still be outlined
729	20x10x10	8	Normal (?) tube ruptured	Cord fibrous. Menstrual age 4 weeks
846	85x40x30	8		Completely dissociated
804	50x10x40	8	Dysintegrated	Free cells fill a cavity 8 mm in diameter
882	60x15x40	8		
756	55x45x40	10		Complete dissociation—menstrual age 6 weeks
685	70x60x50	12	Tube ruptured	Disintegrating—menstrual age 8 weeks
514	70x60x50	15	Tube ruptured	Embryonic mass seems to be composed of the cord
397	40x40x40	20		Thoroughly dissociated with secondary changes in cartilages
478	85x60x45	21.5	Normal	Dead for some time—menstrual age 20 weeks
314		24	Head atrophic	Tissues macerated dissociated and infiltrated
470	90x70x70	80	Very edematous Tube ruptured	Tissues edematous with secondary changes and adhesions—menstrual age 11 weeks

The specimens are arranged according to their length, and it at once appears that

TABLE III

Varieties of ova obtained from tubal pregnancy compared with pathological ova obtained from the uterus

Form and Age	Pathological from Uterus	Pathological from Tube	Normal from Tube
Vesicular forms	19		
Without embryo or amnion	20		
Without embryo	11	31	
2d week	4		
3d week	15	5	0
4th week	21	7	0
5th week	19	8	7
6th week	17	2	11
7th week	10	0	10
8th week	7	0	3
9th week	1	0	5
10th week	1	0	5
11th week	1	0	1
12th week	0	0	1
13th week	1	1	1
14th week	1	0	1
Total	162	74	41

among those containing small embryonic remnants we have nodular and vesicular forms. Then we have a group of larger embryos, which are irregular in form but atrophic. The tissues of these are also more or less dissociated. The third group consists of dead embryos which are markedly dissociated, some of which have fallen entirely into pieces. The change in these specimens indicates that the process was probably of short duration, as it is marked by extremely severe destructive changes.

A comparison of the 117 different varieties of ova obtained from the tube with 162 pathological ova obtained from the uterus is given in Table III.

Of the group of 13 normal specimens spoken of above, 8 came to the laboratory ruptured and 1 was in the act of aborting, another was about to rupture (see Table I). Of 25 specimens containing pathological embryos, only 6 were ruptured, showing again that ruptured specimens usually contain normal embryos. In other words, a live normal embryo is probably far more dangerous to the mother than a pathological one.

It is impossible to obtain any satisfactory data regarding the frequency of the different varieties of specimens obtained from tubal pregnancies. This fact was pointed out also by Werth, who, however, expressed the opinion that only a small number of tubal pregnancies live beyond the first month. Of those that become well imbedded in the tube wall,

TABLE IV

Rate of 100,000 uterine pregnancies

	Frag. bladders	Births	Abortion of Normal Embryos	Pathological Embryos	Pathological Ova	Missed at Term
Number	100,000	80,351	11,765	4,330	7,715	611
Percentage	100	80	12	4.3	7.7	0.6

TABLE V

Distribution of tubal pregnancies in first and second half of about 1000 embryological specimens collected.

Collection of Embryos	Normal Embryos		Pathological Embryos		Pathological Ova	
	Exam.	Unexam.	Exam.	Unexam.	Exam.	Unexam.
2150 specimens	21	4	2	7	4	8
2150 specimens	9	9	0	13	1	39
1000 specimens	30	11	3	29	5	47
Total 117						

only a small percentage survive for any length of time, and probably much less than 1 per cent come to maturity. The chief difficulty in obtaining good statistics is that too few specimens fall into a single hand for study. Thus our own specimens are only numerous enough to indicate the probable proportions. It is even impossible to obtain figures regarding the frequency of tubal pregnancy. The number of operations in a given hospital compared with the total number of patients does not give us any index at all of the true percentage, in fact, surgeons express very different opinions regarding the frequency of this affliction in different districts. Some state that it never occurs in colonial countries, others that it is uncommon in rural districts, and others that it is frequently encountered in cities. A parallel here with the probable prevalence of venereal disease is at once apparent. Beyond this we cannot go at present.

In order to make comparison between the ova and embryos in tubal pregnancy and those obtained from the uterus, I shall first give a table that rests upon all available statistics, most of which were obtained from von Winckel (Table IV).

Considering only those specimens which came to the laboratory unexamined we can

TABLE VI

Eighty specimens of tubal pregnancy which had not been examined before being sent to the laboratory

	Pregnancies	Births	Normal Embryos	Pathological Embryos	Pathological Ova	Monsters
Number	80	0	13	20	47	0
Percentage	100	0	16	25	59	0
Fate of the 16 per cent		3 3		10 5		2 2
Percentage after redistribution of the 16 per cent of normal specimens	100	3 3	0	35 5	50	2 2

build up a similar table, but here instead of 100,000 cases to deal with, we have only 80. It is seen at a glance that the specimens with numbers less than 500 arrange themselves very differently from those with numbers over 500. There are about 1,000 specimens in the collection, and Table V shows the distribution of tubal pregnancy among the first 500 and among the second 500 specimens. It is seen that tubal pregnancies in the second 500 fall off markedly in normal embryos and increase greatly in pathological ova.

The unexamined 80 specimens arrange themselves in a table in which the birth column is zero. Sixteen per cent of the specimens of tubal pregnancy contain normal embryos, 25 per cent pathological embryos, and 59 per cent pathological ova.

It is probable that the 59 per cent of pathological ova would have disintegrated and disappeared in some way if they had not been removed by the surgeon. It is also probable that most of the specimens containing pathological embryos would also have disappeared. Then comes the question as to the fate of 16 per cent of normal embryos. A glance at Table I shows that most of them rupture or abort, but no doubt the few that remain within the tube may continue to the end of gestation, although some of them die and are aborted. In fact, Werth gives a case in which the skeleton of a very small foetus about the size of a bean was found encapsulated within the tube lumen at the end of 13 years.

I have attempted to express in Table VI the redistribution of this 16 per cent in cases in which the foetus continues to grow to the

end of pregnancy, using as a guide the proportion of anomalies in tubal pregnancy at term as given by von Winckel. Of course this would not always be their fate, because most of this group die long before the end of gestation; but if this redistribution is made, it is found that of 100 tubal pregnancies 33 per cent would have reached birth, the pathological embryos would be raised from 25 to 35.5 per cent, and there would be added about 2.2 per cent of monsters. This row of figures can now be compared with the percentage of specimens obtained from 100,000 uterine pregnancies. If this is done it is apparent that the pathological action in tubal pregnancy is far more severe than upon the pathological ova obtained from the uterus. In tubal pregnancy the embryo is quickly destroyed, the ovum is easily detached and becomes necrotic, and is absorbed or aborted. A normal embryo eats through the tube wall, and many of them are also aborted. The appearance of a pathological embryo from the tube is much like that of one from the uterus, but the destruction of tissue is more severe. All this points more toward complete strangulation in the tube. The uterus appears to be a more favorable site for pathological embryos which continue to live. This variety is less frequently found in the tube. It is probable that all small monsters and pathological ova that remain in the tube disintegrate.

There is a marked difference between early and late monsters from the tube and those from the uterus. In the former there is a marked gap between these two varieties. In the uterus there is a finer gradation from one to the other. The conclusion of our study of tubal pregnancy regarding this point is that there is a break within the pathological group in the tube, thus we have the early stages in which the changes are very severe, and later stages which show special varieties but which seem occasionally to include specimens in which pathological changes must have begun very early. It may be that change in the spinal cord in No. 808 might have continued to the end of gestation to produce a spina bifida. Otherwise the tubal monsters at term must have arisen from specimens which

TABLE VII

Date	Author	Number of Specimens	Number of Monsters
1876	Henning	250	2 and 6 compressed fetuses
1894	Orillard	6 (alive)	6
1893	Schelling	257	25
1891	Küchenmeister	43	7
	Harris	45 (alive)	11
1901	Sittner	125 (alive)	26
1902	V. Winckel	13 (alive)	13
	Kehrer	93 (uterus bicornis)	7

were normal up to the twelfth week. No doubt the normal specimens of the sixth, seventh, and eighth weeks are of the kind that produce monsters at the end of pregnancy, as described by von Winckel. In fact, there is every indication that No. 657 might have turned into a monster, as it appears to be somewhat atrophic.

I have been unable to collect any good data regarding the frequency of monsters in tubal pregnancy, but according to Joachimsthal they are very rare, and according to Leopold they are relatively rare, while Martin and Orthmann, Ruge, Olshausen, and Veit state that they are more common than in uterine pregnancies. It may be that the latter gynecologists confused early pathological embryos with older monsters, while the former did not. The line of demarcation between them is difficult to draw, hence the distinction is not frequently recognized.

Von Winckel has done us a service in collecting those fetuses from tubal pregnancies which continued to live and were removed alive from the abdominal cavity. His fetuses must have arisen from the 16 per cent of normal embryos found by me in unselected unruptured tubes. Eighty-four per cent of my specimens were so markedly pathological and so far destroyed that they could not possibly have lived until the end of pregnancy. Von Winckel's cases are especially valuable for determining the fate of the embryo that must have been normal before the tube ruptures, that is, during the first months of pregnancy. Von Winckel first gives the cases that have been published by others, as follows:

It is seen in this table that the percentage of monsters increases from year to year. However, von Winckel thinks that it is safe to say that one half of the fetuses in ectopic pregnancy are deformed, the most common deformity being defects of the hands and feet. He collected 87 cases (14 of his own) and found that in 57 of them the fetuses were much deformed and in 12 were markedly monstrous. Among these there were 6 cases of hydrocephalus and 1 each of hydromeningocele, encephalocele, anencephalus, omphalocele, spina bifida, and hyospadia. In addition, the head was found deformed in 57 specimens, the legs in 44, the arms in 35, in 12 there were club-feet, and in 4 cases amniotic bands. The placenta was usually deformed, sometimes multiple, broad and thin, or short and thick, and often very hemorrhagic. In general, then, it is the poles of the body that suffer most, the head being deformed in 75, the legs in 50, the arms in 40, and the trunk in 4 per cent of the cases. But while it is clear that a good share of the difficulty is due to ordinary mechanical causes, in the 12 cases that were markedly monstrous these could not be the sole factor, for them we must hold the hemorrhagic placenta responsible, a growth that could be included under what I have termed faulty implantation. Therefore, 14 per cent of von Winckel's 87 tubal cases which were normal in early pregnancy become monstrous, while in uterine pregnancies the percentage is below 1.

TUBAL PREGNANCIES CONTAINING PATHOLOGICAL OVA

Pathological ova without embryos are very frequently encountered. In our selected cases 59 per cent fall under this heading, while in specimens obtained from the uterus there are only 27 per cent. Moreover, in both sets the figures are probably much too small, as no doubt many of the earlier specimens are lost or overlooked. We have no good data regarding the number of ova which disintegrate early, but the study of comparative embryology warrants the conclusion that many young ova degenerate and disintegrate. I am informed by Doctor Huber, who has studied with great care much material

TABLE VIII
Pathological Ova

Catalogue No	Dimensions of Tubal Mass in mm	Dimensions of Ovum in mm and Menstrual Age	Villi and Coelom
154		10x10x10	Fibrous
298		4x4x4 (5 weeks)	Fibrous
361		10x10x10 (7 weeks)	Dense reticular and granular magma. Tubal abortion
367		10x7x5 (2 weeks)	Dense reticular magma
369		(3 weeks)	
378		11	Granular magma
415	40x10x20	(6 weeks)	Villi almost hydatiform
418	50x25	7x4 (5 weeks)	Fibrous (Collapsed)
439	60x35x35	25x20x15	Scattered necrotic villi
472			Scattered fibrous villi
488		(5 to 6 weeks)	
495	30x25x25	12	Dead membranes
507	50x35x35		
513	70x30x30	15x10	Fibrous.
514	15x8x8		Few degenerate villi
515		15x12	Fibrous villi
517	40x30x30		Granular mass in amnion
519			Scattered villi
520	60x35x30	5x3x3	Collapsed ovum
539	40x8x8	10x6x6	Scattered villi
549	50x16x16	2	Attached to fold
553	30x15x15	5 (8 weeks)	Collapsed ovum Many Hofbauer cells
561	28x22x22	Collapsed (11 weeks)	Granular magma
579	25x12x8	Collapsed (6 weeks)	Fibrous villi
575	40x23x18	5	Necrotic and mucoid villi
602	30x25x25	23 (11 weeks)	Degenerate villi. Tubal abortion
659	30x15x10		Few villi
673	10x16x16	6x3 (11 weeks)	Collapsed
686	70x50x30		Detached ovum
694	40x10	15x12	Fibrous and necrotic
720	90x30	(7 weeks)	Mucoid villi
726	60x40x30	(12 weeks)	Few villi
734	50x25x25	Collapsed ovum (2 weeks)	Mucoid and necrotic
741	70x50x40	18x6 (10 weeks)	Fibrous and necrotic
754	70x25x15	2x2 (5 weeks)	Necrotic
761	65x25x35	(6 weeks)	Necrotic (scattered)
765a	75x30x30	5 (8 weeks)	Necrotic
772	10x10x15	(4 weeks)	Degenerate (scattered)

Catalogue No	Dimensions of Tubal Mass in mm	Dimensions of Ovum in mm and Menstrual Age	Villi and Coelom
773	55x20x15		Fibrous (scattered)
775	70x40x35	Collapsed	Necrotic and fibrous
777	75x55x55	5 collapsed (11 weeks)	Few necrotic villi
787	40x11x11		Few fibrous villi
794	60x20x20	None	Possibly a few trophoblast cells
809b	60x40x30		Few necrotic villi
809c	80x45x35	Collapsed (4 weeks)	Scattered necrotic villi
815	50x30x25	Collapsed (5 weeks)	Necrotic villi
825	90x40x25		Double ovum with quite normal chorion
835	40x30x30		Few scattered fibrous villi
874	80x30x25	Ovum broken (7 weeks)	Villi very active
889	50x25x25	(6 weeks)	
891	60x30x30	Ovum 20x5	Necrotic
892	90x15x15	(11 weeks)	Fibrous villi

from rats, that some of the fertilized ova break down before implantation. The same seems to be true regarding the pig. We usually find more corpora lutea in the ovaries than embryos in the uterus, indicating that all of the ova do not produce embryos.

A glance at Table VIII, which includes all the pathological ova studied, shows that most of them are less than 10 mm in diameter. Many of them are small because they are collapsed. At one time they were larger, but as a result of excessive hemorrhage they became detached, and the collapsed ovum indicates that it is degenerating. Very few of them are in process of abortion and none of them have ruptured through the tube wall. The ova are simply being disintegrated. This is indicated by the pathological condition of the magma, which is densely reticular and often very granular. The wall of the chorion is degenerating and the line of demarcation between it and the coelom is often obscure. Strands of cells extend from the chorionic wall into the coelom, and the main wall of the chorion is often ruptured. The villi usually show a variety of degenerative changes of which the most common is fibrous, but often mucoid. The trophoblast is usually scanty or necrotic with disintegration of the

nuclei, forming nuclear dust. When this is liberated, it is scattered through the specimen. The dead villi are soon invaded by leucocytes, and also by adjacent trophoblast which feeds not only upon them but also upon necrotic masses of trophoblast. As the ovum collapses it also begins to break up. The villi are detached and scattered in the blood clot. The isolated villi may continue to grow, in case they are capped by active trophoblast which continues to tap fresh vessels. As the blood-clot becomes larger the single villi are separated more and more, ultimately undergoing complete degeneration. In a few instances the whole ovum breaks into pieces. It first becomes hourglass-shaped, the two parts then separate, and in one case (No. 874) one part is aborting whereas the other part

is near the uterus, where it is still growing actively. Finally, the villi practically disappear, the clot becomes smaller and organized. These very small clots which are found in the tube are composed almost exclusively of fibrin, containing a few small degenerating villi. At any time during this process the whole tubal mass may be extruded and bring the pregnancy to an abrupt end. In case this does not take place, the clot probably disappears entirely by absorption. My material does not warrant any statement regarding the ultimate fate of a small fibrous clot or of an excessive hemorrhage in the tube, which contains within it a few fibrous villi; nevertheless, the suggestion that the latter may have some relation to hematosalpinx, hydrosalpinx, and pyosalpinx, is pertinent.

THE PYLORUS. OBSERVATIONS UPON ITS MUSCULATURE¹

By P. I. TRUESDALE, M.D., FALL RIVER, MASSACHUSETTS

PYLORIC insufficiency is a well recognized barrier to the normal motor function of the stomach. Its causes have hitherto been ascribed essentially to ulcer or cancer. Hypertrophy and atrophy of the musculature of this region as accessory causes have not been recorded nor have the influences of such changes been considered in the application of surgical principles to the treatment of lesions of the stomach.

Examinations of our resected pyloric specimens for ulcer fifteen in number have revealed the interesting fact that such changes do occur and often to a notable degree. The muscular coats of the pyloric end of the stomach and the pyloric sphincter muscle exhibit a distinct overgrowth in the presence of ulcer of the stomach or duodenum. The degree of hypertrophy appears to vary considerably and is presumably governed by the measure of activity on the part of this region of the stomach. Whereas, after gastro-enterostomy, with the stoma functioning well, the musculature of the pyloric end of the stomach, especially the pyloric sphincter,

becomes atrophied and atonic. These variations in the musculature of this region are what one would expect to occur in muscle-tissue in other parts of the body during continued periods of excessive function and of extended rest. It remains for us to interpret the significance of these transitions. Obviously, they possess a physiological bearing of considerable meaning but it is my purpose to deal with their relation to the more common surgical procedures of the stomach.

The failures of gastro-enterostomy have been measurably surmounted by an improved technique and a more judicious selection of cases. Nevertheless when employed as a single procedure its career is even now admittedly uncertain, and a study of its disturbing sequences may prove valuable in determining whether or not the future operation of choice for ulcer of the stomach or duodenum should leave the stomach permanently with a single or a double outlet.

After excision or infolding of the ulcer, attention has been for the most part centered around the anastomotic opening. Its posi-

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tion in the stomach and jejunum, its dimensions, its angle, its suture line, etc., have exacted the most diligent research. A recent and distinct advance consists in a better choice of suture material as advocated by the Mayos (1). But this more or less continued variation in the technique of gastro-enterostomy would appear to indicate no small measure of dissatisfaction with its results.

The normal pylorus scarcely admits the tip of the little finger. The diameter of its sphincter muscle when hardened measures approximately 0.5 cm. It is plastic but rarely does it yield to the dimensions of the average gastro-enterostomy opening. Artificial openings are made large because the small stoma appears to have been ineffectual. A stoma of moderate size would probably be adequate provided its efficiency were not embarrassed by a transition at the pylorus. The structure of interest here is the muscle bundle which embodies the pyloric sphincter. Like the muscular coats of the entire pyloric antrum, it is subject to the variations described above. Whenever the symptoms of pyloric obstruction dominate the clinical picture and the lesion is ulcer, either of the stomach or duodenum, we have observed an overgrowth of the muscle in some cases, reaching 1 cm. and more in diameter. The same specimens showed that the cicatrix of the ulcer played a relatively minor part in the process of occlusion. If these observations are confirmed by further study and by other investigators, an additional factor is produced in clearing up the cause of benign obstruction at the pylorus. At the same time we may possess a partial explanation at least of the immediate success of gastrojejunostomy and the gastric disturbances which recur months or years after operation. This fact in itself, that symptoms often return from six months to two years after gastrojejunostomy, lends weight to the theory of a gradual loss of muscular control at the pylorus following this operation. This deficiency results in a return flow of the contents of the duodenum into the stomach. Findings at secondary operations have confirmed this view. Furthermore, one is inclined to assume that patients who have acquired the greatest degree of muscle hyper-

trophy at the pylorus, as a class, obtain the most lasting benefit from gastrojejunostomy. The reverse, however, is not necessarily true, since it is generally known that the artificial opening and the pylorus may be functioning together, or the pylorus alone in the presence of a stoma, and the patient continues to remain well. However, there is always an un-failing hope on the part of the surgeon who does gastrojejunostomy for ulcer that in some way the pylorus will close and remain so, for the permanently good results following this blockade are universally recognized.

The cicatrix of an ulcer, especially in the duodenum, must rarely occlude the pylorus. Obstruction elsewhere in the intestinal tract, as from the ulcers of typhoid fever, for example, would be considered very unusual. It is obvious, however, that the edema and engorgement surrounding the ulcer must share to some extent in the occlusion, but this process is transitory and is subject to prompt relief after gastro-enterostomy. One of our pylorotomies was done eleven days after gastro-enterostomy for an ulcer mass which, upon inspection, I believed to be carcinoma. The second operation revealed a marked improvement in the size and appearance of the tumor due to an amelioration of the inflammatory zone. This is an observation commonly made by other surgeons. Except in the presence of a neoplasm, then, permanent obstruction of the pylorus cannot be assured except by division or excision. Here it may be observed that the success of the Finney operation of pyloroplasty, when practicable, is generally conceded, and that Finney (2) in his operation divides the hypertrophied sphincter muscle completely and permanently. No doubt the logic of his operation is thus explained.

Whenever the pyloric sphincter is hypertrophied and no lesion can be discovered in the stomach or duodenum, the region of the gall-bladder and the appendix should be carefully investigated, for somewhere in the intestinal tract there must exist a lesion to account for this secondary change which may be due to spasm of reflex origin unless the hypertrophy is congenital, an anomaly which must be rare and not inconceivable.

May not the congenital pyloric stenosis now so frequently observed in infants be a partial stenosis and yet a permanent one? Into this class might reasonably be placed an occasional case of "spasm" of the pylorus, considered in infants to be due to improper feeding and not demanding surgical treatment. Most of these cases get well with appropriate food. Is their recovery always permanent? Scudder (3) has shown that the pyloric tumor in infants does not disappear after gastro-enterostomy. The overgrowth of muscle results in permanent closure of the pylorus. If this congenital deformity is one of degree, there follows the natural assumption that an individual who has had gastric discomforts so long as he can remember may have a partial stenosis that is congenital. The correlation of this lesion in the adult and the infant was originally based upon the pathological studies of Maier (4). Two of our adult specimens showed a fusiform overgrowth of the pyloric muscle corresponding to the arrangement of muscle-fibers in the congenitally hypertrophied pyloric muscle. In one of these cases the history of gastric disturbance dated to a period as remote as the patient could remember. "A history of indigestion since the patient was two years of age" was an impressive sentence in the history of a male adult recited in a large clinic recently where complete records are a feature. A possible appendix and a thickened pylorus were the sole evidence that in any way could explain the history. This is not an uncommon picture, and it is a disquieting admission that appendicectomy does not always achieve success.

Hypertrophy of the pyloric sphincter muscle may have a further significance. McCarthy (5), in an article on the "Pathology and Clinical Significance of Stomach Ulcer," writes as follows: "A few cases give previous histories which appear to be appendicitis. This coincident, if it be a coincident, is well worth considering, however, as a possible etiological factor. Lithauer has produced ulcers which do not heal by the production of localized anemia and destruction of the mucosa. These clinical and laboratory experiences are sufficiently striking

to warrant further study and experimentation in regard to the possible production of pylorospasm, gastric anemia, hyperacidity and necrosis, or ulceration of the mucosa." The hypertrophied pyloric sphincter muscle would at least appear to be a link in this chain of thought.

Inhibition of the function of the pylorus results in atrophy of its muscular coats and of the pyloric sphincter. Whether this interference is due to adhesions of the pyloric end of the stomach to the parietal peritoneum and adjacent viscera or to a perfectly functioning stoma, or both, the ultimate change in the musculature will probably be the same. The importance of this alteration is apparent when, in a given case, the degree of muscular atrophy is so marked that the pyloric sphincter entirely loses its function of control. This is illustrated by the findings in one of my cases, a pylorectomy six years after gastro-enterostomy. The anastomotic operation had been done by a master surgeon. When I opened the abdomen, examination revealed the pyloric end of the stomach and first portion of the duodenum extensively involved in adhesion. The first portion of the duodenum could readily be invaginated into the pyloric end of the stomach with the thumb, so atrophied and atonic was the pyloric sphincter. An examination of the stoma showed some induration and redness around the suture line. Suspecting an ulcer here, I opened the stomach transversely at the antrum. The stoma admitted two fingers readily and the mucous membrane was normal throughout. The contents of the duodenum poured into the stomach through the dilated pylorus. The stomach was wiped out, the pyloric opening packed with a sponge and the stoma observed. Nothing entered the stomach through this artificial opening. This observation explained the presence of bile in the test meal and an excess of 40 ccm removed one hour after ingestion. Therefore relaxation of the pyloric sphincter is accompanied by a reversed flow in the duodenum, and the duodenal contents enter the stomach through the pylorus as in this case. This phenomenon is in harmony with the laws governing in-

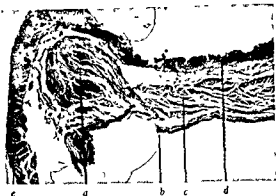


Fig 1 Microphotograph of section through normal pylorus. Subject was a male aged 45 who died of a cerebral tumor. No lesion was found in the gastro intestinal tract. a Pyloric sphincter muscle b peritoneum c musculature of the pyloric end of the stomach d gastric mucosa e duodenal mucosa



Fig 2 Microphotograph of section through the pylorus in the presence of ulcer of the lesser curvature of the stomach 4 cm from the pylorus. Note the overgrowth of muscle a Pyloric sphincter muscle b musculature of the pyloric end of the stomach, c edema of the submucosa, d gastric mucosa e duodenal mucosa

testinal movements referred to in the researches of Cannon (6), Starling (7), and Nothnagle (8). Cannon (9) reminds us that the presence of acid in the duodenum closes the pyloric sphincter and an increasing acidity on the side of the stomach causes a relaxation of the orifice. Atrophy and dilatation of the pyloric sphincter therefore, after gastro-enterostomy is enhanced further by acid in the stomach and an absence of acid in the duodenum. In the presence of this altered chemistry there occurs a progressively increasing muscular relaxation and ultimately an inability on the part of the pylorus to maintain an intermittent closure.

The following cases briefly stated serve to demonstrate the influence of gastrojejunostomy upon the pyloric musculature with consequent disturbance of stomach function.

CASE 1 H C male age 46 married born in England. Family history and past history not remarkable.

Previous illness. Stomach symptoms for about twelve years consisting of distress two to three hours after meals. Occasional nausea. Rarely vomited. No night attacks. Food relief present. Bowels constipated. Decreased twelve pounds in weight. Test meal. No free hydrochloric acid. Yeast cells. No sarcine. Large bacilli. No leucocytes or red blood corpuscles.

Operation. June 27 1913. Posterior gastro-enterostomy for ulcer of the duodenum and appendicectomy. He was symptomatically well for four months during which time he regained his average weight. Digestive symptoms then began

to recur. Distress two or three hours after eating. Vomited every morning. Lost fourteen pounds in the last six months. Medical treatment gave only temporary relief. Bismuth radiographs by Dr Dodd of Boston. Writhing of duodenum noticed and stasis in the loop. Operation, April 24 1914. Adhesions involved the pylorus. The pylorus was patent and atonic. The stoma was adequate and healthy. Von Eiselsberg's operation was done. One year after second operation this patient is symptomatically well.

CASE 2 J M B male age 40 married, born in Ohio. Family history and past history not remarkable.

Previous illness. In 1907 he was operated on in Columbus for acute perforated ulcer of the duodenum. Eight months later gastro-enterostomy was done. He was well for a year when symptoms though mild at first recurred. For the past five years he has had occasional attacks of indigestion lasting from two to three days with distress two to three hours after meals, promptly relieved by soda. He has maintained his average weight. For the past six months he has often been forced to wash out his own stomach, especially at night because of epigastric distress. There has been no vomiting but occasional nausea. Two weeks before his last operation stools were noted to be tarry. Long-continued periods of medical treatment only accomplished partial and temporary relief.

Test meal. Excess of 40 ccm by the tube. Free hydrochloric acid 25. Total acidity 40. Much bile. Bismuth radiographs by Dr J H Lindsey. X ray diagnosis. Ulcer of duodenum. Stasis in the loop. Pylorus patent. Stoma functioning.



Fig 3 Microphotograph of section through pylorus and first portion of the duodenum. Ulcer of the duodenum. a, Contraction of peritoneal layer of healed duodenal ulcer. b peritoneum, c gastric mucosa. d pyloric sphincter muscle showing marked hypertrophy.

well. Operation, February 20 1915. Pylorectomy. There were dense adhesions of the pyloric end of the stomach to the parietal peritoneum. The pylorus was dilated and atonic readily admitting the thumb. The suture line surrounding the stoma was considerably thickened. Suspecting ulcer I opened the stomach by a transverse incision. The stoma admitted two fingers and the mucous membrane was everywhere normal. Bile colored fluid poured into the stomach through the dilated pylorus while nothing entered the stomach by way of the artificial opening. The pyloric opening was closed by a gauze pack and the stoma then observed. Nothing entered the stomach by this opening. Pylorectomy was done (Figs 4 and 5).

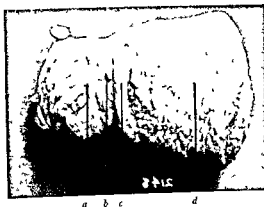


Fig 5 Photograph of the pyloric end of the stomach and about 2 cm of the duodenum removed 6 years after gastro-enterostomy. a Duodenal mucosa, b small crater of ulcer, c, pylorus atrophied and widely dilated muscle, d, mucosa of pyloric end of stomach.

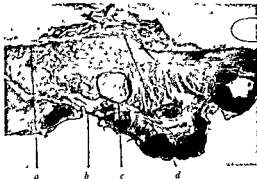


Fig 4 Microphotograph through the pylorus six years after gastro-enterostomy. a, Peritoneal layer, b, base of ulcer, c, atrophied pyloric sphincter muscle, d, omentum and infiltration over site of perforation seven years ago.

CASE 3 H B, male, age 57, married, born in England, upholsterer. Family history and past history not remarkable.

Previous illness. Stomach symptoms began about 1907. He was in the Massachusetts General Hospital for observation in 1911, where diagnosis of peptic ulcer was made.

His symptoms consisted of distress two hours after eating relieved by food or soda. Night attacks were common. Stools tarry. At times constipated. Operation November 13, 1911. Posterior gastro-enterostomy for chronic ulcer on the superior surface of the first part of the duodenum, appendix removed. He remained well for two years when his ulcer symptoms began to recur and increased in severity until he was afraid to eat. During this time he had had medical treatment. There has been no nausea or vomiting. His weight has decreased twelve pounds since recurrence of symptoms.

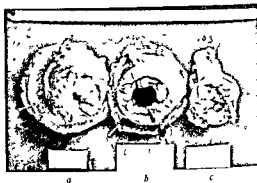


Fig 6 Photograph looking into pyloric lumen from the duodenal side. a Normal pylorus. b, atrophied atonic pylorus two years after gastro-enterostomy. c stenosed pylorus from ulcer.

Operation, March 6, 1915 Dilated atonic pylorus (Fig 6, b) Cicatrix of healed ulcer Healed ulcer Pylorotomy

In presenting a summary of this paper, I am mindful of the limited number of specimens studied, of the wide variations observed in the degree of overgrowth and atrophy of the pyloric muscle and of the difficulties of precise interpretation of these phenomena in relation to clinical events Nevertheless, the evidence thus far obtained demonstrates that—

1 Hypertrophy of the musculature of the pylorus, especially the pyloric sphincter, is found in the presence of gastric and duodenal ulcer

2 The hypertrophied muscle is a factor in obstructing the pylorus

3 Atrophy of the musculature of the pylorus is a sequence of gastro-enterostomy

4 Progressive atrophy of the pyloric mus-

cle often defeats the success of gastro enterostomy

5 These changes in the musculature are the result of varying periods of excessive function and of extended rest

6 Hypertrophy of the pyloric sphincter muscle may be of congenital origin

For the pathological specimens and many valuable suggestions in connection with this study, I am indebted to Dr Annie C Macrae

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DISCUSSION

By DR MURPHY AND DR LINHORN

DR FRDERICK MURPHY St Louis This paper, I think opens up a very important and relatively new field of observation The reader has centered our attention upon the really important section of the stomach With these details namely, the hypertrophy and atrophy of the muscle layers I have no observations to present for comparison, but it seems to me a very fertile field for investigation and we shall certainly try to confirm or disprove these observations They may offer, I believe true explanation for failures which we find in certain cases in the post operative behavior As a result of hypertrophy of the pyloric musculature which we see at the time of operation, we have obstruction, then with the final atrophy we again have the pylorus reopened and our vicious circle reestablished This muscular plane may play a more important part than we think it has in the past

One statement I greatly appreciate that the results of gastro enterostomy without obstruction of the pylorus are at least uncertain That impressed me as a fair honest statement of the conditions which the average man finds It certainly coincides with our cases in the Middle States

In the cases where there is frank obstruction at the pylorus gastro-enterostomy gives brilliant results In the cases where there is no such obstruction our results are extremely disappointing

The idea that the gastro enterostomy is a panacea for all lesions of the stomach seems to me to be absolutely in error and not to be in accordance with

the facts as men generally observe their cases if they follow them sufficiently long

In these cases which the doctor has shown, I believe there is instituted a very logical treatment of the lesions which are non-obstructive In the first place, an absolute obstruction of the pylorus is made, and in the second place the dangerous area of the stomach is removed

Of course, it is going to take a deal of experience and a very careful analysis of cases to warrant the statement that the percentage of malignant degenerations is sufficiently high to warrant pylorotomy in all cases of ulcer of this region We had some twelve cases, I think, in which the results have been admirable, where the ulcer has been non obstructing and where the entire pyloric end has been resected and the old gastro-intestinal canal reestablished by some such operation

Dr Truesdale did not have the time in his paper to go into details, but had he had the time I am sure he would have emphasized the difference between lesions of the stomach and lesions of the duodenum It seems to me that that is one point which is too often lost sight of

In the region of the duodenum we have changes resulting either from the scar or the spasm We do get our obstruction, and therefore the gastro-enterostomy gives, in every one's hand, relatively good results In lesions away from the pylorus, however, the results are, I believe, as the doctor has mentioned to say the least, uncertain

Dr FINKHOFF, New York City. I am very glad to be here to discuss Dr Truesdale's very valuable paper. I saw his specimens and studied them a little while ago, and I certainly think that he deserves a great deal of credit for doing such important work.

My experience in this field has not afforded many opportunities to observe hypertrophy of the pylorus as a common cause of obstruction, for I have not made many sections of the pylorus. Usually the stricture, as it seems to me, is caused by scar tissue or in some instances ulcers of the pylorus which precede muscular spasm. In the cases I have observed there was no apparent hypertrophy, but as the reader said, this condition of hypertrophy develops if there is a considerable and continued spasm, and we would say in a year or so such changes occur as a functional disturbance. Now, with regard to the atrophy, a similar condition may exist too, as he says, after gastro enterostomy as the result of a greater limitation of the normal action of the pylorus.

I would like to call attention to a class of cases in which there are two things present at the same time: a lack of motility and a lack of patency of the

pylorus. The pylorus can neither close entirely nor can it open well, and this is found not only in malignant diseases, but in benign conditions as well. Fibrous tissue may interfere with the function of the pyloric muscle so that it cannot normally open and close. I have seen cases where a good operation had been done primarily, and have found that condition interfering with the success of the gastro enterostomy.

With regard to the function of an organ going on in the presence of definite pathological changes, I have discussed this topic before about eighteen years ago especially with regard to the circulatory function of the stomach. I have tried to demonstrate that oftentimes the pathological changes are not the cause of the functional disturbance, but that the functional disturbance existing a long time may induce pathological changes for example pathological lesions which follow functional changes in the mucosa as a result of disturbances of the circulation. I have written upon this subject and I believe that it is the theory which attracts a great deal of attention. This observation was based upon a theory similar in principle to that which Dr Truesdale has now demonstrated.

DIAGNOSIS OF INTRATHORACIC NEOPLASMS BY EXPLORATORY PUNCTURE¹

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THE following case is reported as demonstrating the diagnostic value of examination of the tiny fragment of tissue obtained by exploratory puncture with an aspirating needle of moderate size in cases of intrathoracic lesions of doubtful character, and as a plea for the utilization of by products

II T., a musician single age 19 entered the New York Hospital on April 2, 1913 complaining of pain in the right side, and cough. His family history was negative for tuberculosis. He had had no previous pulmonary or other illness excepting gonorrhea nine months before admission followed by double inguinal adenitis six months later. Soon after this he began to have sharp pain in the right side, increased by deep breathing or coughing. The latter occurred in attacks every morning on arising, but was unproductive. There were no other symptoms. Over the right chest posteriorly from the spine of the scapula to the base were dullness increasing to flatness diminished fremitus, breath and voice sounds, and voice and whisper of nasal

quality with a few subcrepitant râles. A needle inserted into the right chest yielded a syringeful of bloody fluid containing many small opaque particles which consisted of cells resembling epithelium. The physical examination showed nothing else of significance. Fluoroscopic examination on the following day showed a shadow extending from the spine of the right scapula to the diaphragm, the upper limit of this shadow having a convex outline. Within this area of shadow were two semitransparent areas. A radiogram by Dr A. H. Busby was reported as showing pleurisy with effusion. There was a daily afternoon rise of temperature of 1° to 2° F. The rectal temperature only once touched 101°, usually reaching 100° to 100.6° in the afternoon for nine days, subsequently rarely exceeding 100°. The pulse ranged from 72 to 112 generally being about 83. Blood examination showed 6,140,000 red blood cells with 40 per cent of hæmoglobin. Leucocytes numbered 10,500 on several examinations but ranged from 7,300 to 18,000. The polymorphonuclear leucocytes ranged between 34 and 85 per cent mononuclears between 16 and 26 per cent basophiles from 0 to 2 per cent. The eosino-

¹ Read before the Section on Medicine, New York Academy of Medicine, March 26, 1915.



Fig 1 Angiosarcoma of lung diagnosis confirmed by specimen obtained with aspirating needle

philes numbered 1 per cent, 11 per cent, 16 per cent, 7 per cent and 7 per cent on successive examinations. The Wassermann reaction was negative. Seven stools were negative for blood, ova, and parasites. There was no sputum to be examined for tubercle bacilli.

On April 9, a loud friction rub was heard over the whole right chest anteriorly and the nasal quality of voice was confined to a small triangular area at the base of the right axilla. Three days later, slightly nasal voice was heard anteriorly from the level of the nipple down and in the seventh space posteriorly. A less marked friction rub than before was present over this region anteriorly. On April 14, the patient began to complain of pain in the right lumbar region which varied in intensity during the remaining two weeks in the hospital. On the 15th examination showed the cardiac apex beat in the fifth space, 12.5 cm. to the left of the median line and in the right chest tympany over an area 6 to 7 cm. wide to the right of the midsternal line. Over the rest of the right chest anteriorly, from the second rib down, was marked dullness increasing to flatness. Over both these areas was a loud friction rub especially when recumbent. Posteriorly from the fourth rib down, signs were as on admission excepting that nasal voice was quite marked near the vertebral column from the eighth space down. There was tenderness of the right quadratus lumborum and prominence of the first and second lumbar vertebral spinous processes, but a radiogram of this region was negative. The patient lost six pounds in twenty-six days.

The convex upper level of the shadow in the chest and semitransparent areas within it, the blood-tinged chest fluid, the displacement of the heart toward the left, the presence of a tympanic area

between the area of cardiac dullness and that of dullness in the right chest anteriorly, with a friction rub over the area of dullness, the persistent eosinophilia in the absence of intestinal parasites or other obvious cause, and the irregularity of the areas of nasal voice—all suggested the existence of a neoplasm rather than a serofibrinous pleurisy. To substantiate this opinion a needle was inserted into the right chest in the ninth space near the angle of the scapula in order to obtain a fragment of tissue for examination. It encountered resistance from the start. This became greater within the chest and then about 3 cm. of a blood-tinged serous fluid was obtained, which did not coagulate on standing and in which were two small fragments which resembled thick mucus enclosing shreds of tissue. The fluid showed chiefly lymphocytes with a few eosinophils, polymorphonuclears and basophils. The fragments of tissue obtained were cut and stained at the laboratory of surgical pathology of the College of Physicians and Surgeons. The sections measured about 1 mm. in diameter and 1.5 mm. in length. They were examined by Dr. Wm. C. Clarke, who made the diagnosis of angiosarcoma.

On April 29, the patient was discharged from New York Hospital and on May 3 he entered the German Hospital through the courtesy of whose superintendent I am able to record the termination of the case. On May 28 the tumor was removed from the right chest and death occurred the same day. The neoplasm is described as a "malignant cellular tumor composed of small round cells closely packed together, with no definite stroma and with a minimum amount of finely granular intercellular substance. The blood vessels are rather numerous and possess exceedingly thin walls. The tumor cells themselves surround these blood vessels in

the form of a mantle. This perivascular arrangement is more noticeable in some fragments than in others and probably represents the proliferation of the tumor cells in the perivascular lymph spaces, otherwise there is no trace of the original pulmonary tissue."

Encouraged by the success in diagnosing this case, the writer has attempted the same unsuccessfully in two others. In one, the tumor was found at autopsy to be confined to the root of one lung, where puncture would have been dangerous, the rest of the lung showing pneumonic consolidation. In the other, no autopsy was obtained, but the diagnosis was confirmed by removal of a supraclavicular lymph node which showed infiltration of the surrounding tissue with cells resembling those of so-called "endothelioma" of the pleura. In this case the fragments obtained by puncture consisted of fibrinous exudate containing lymphocytes

with a single group of large, unevenly staining cells which resembled mesothelium.

Examination of fragments of tissue obtained by exploratory puncture, employing a needle with a lumen of about 1 mm., is of diagnostic value only when the results are positive, but in these instances it may be of real assistance in differentiating from syphilis, tuberculosis, and delayed resolution of pneumonia. The dangers of exploratory puncture are those associated with perforation of a solid or chronically inflamed lung, the most serious of which are hemorrhage and cardiac or respiratory failure, convulsions, coma, or transient paralysis from pleural reflex,¹ but these are sufficiently rare to be disregarded when diagnostic information is needed. Puncture near root of lung should be avoided, as these accidents are most common when this portion of lung is wounded.

¹Dayton. *II Surg. Gynec. & Obst.*, 1911, xxi, 607.

OSTEOMYELITIS OF THE LOWER JAW

ITS PROPER TREATMENT, INCLUDING BONE GRAFTING, SHOWING THE NECESSITY OF ASSOCIATING THE DENTAL SURGEON WITH THE GENERAL SURGEON²

BY HENRY SAGE DUNNING, B.S., M.D., D.D.S., CLARENCE A. McWILLIAMS, A.M., M.D., F.A.C.S.,
AND A. F. MITCHELL, D.D.S., NEW YORK

BY H. S. DUNNING, B.S., M.D., D.D.S.

OSTEOMYELITIS osteitis and necrosis of the inferior maxilla occur very frequently in spite of the wonderful blood supply of this part. We see a great many cases of necrosis of the inferior maxilla at oral surgery and dental clinics of this city, and many of these cases result in loss of the teeth and portions of the maxilla and sometimes terminate in marked facial deformity. The alveolar processes of the maxilla become infected and necrosed more often than any other bones in the body on account of their thin covering of gum tissue, and because they lodge and are in direct communication with thirty-two teeth that are subject to infection at any time.

Infected teeth are insidious "volcanoes"

that need very little to start them off into active eruption. Very few mouths of adults contain teeth that are not infected or have not been infected, and many mouths of persons over 35 years of age contain teeth that are abscessed or were abscessed at one time. Many devitalized infected teeth are dormant for years and do not cause the patient any noticeable inconvenience and the attendant necrotic condition is only discovered by radiograph examination.

The inferior maxilla readily absorbs in section from the teeth on account of its spongy, alveolar process also on account of its position under the infected teeth. The infection naturally drains downward toward the bone into the inferior dental canal, and this is one reason why the inferior maxilla becomes infected more often than the superior

²Read at a meeting of the New York Academy of Medicine, April 2, 1915.



Fig 1 Showing marked facial deformity resulting from chronic osteomyelitis of the inferior maxilla. Many operations were performed covering a period of ten years. The deformity was caused by infection of the temporary molars when a young boy.



Fig 2 Shows a young man 20 years old married Wassermann negative. About four months before pictures were taken had toothache lower first molar. The tooth was treated and became abscessed. The abscess seemed to spread to other teeth. It was opened very liberally outside of face by a surgeon. Three large incisions were made. The condition did not clear up and every tooth in the young patient was extracted. The bone was then vigorously curetted and most of the jaw removed.

maxilla where the teeth drain downward away from the bone.

Necrosis is generally a self-limited process, but we find cases where one half three-quarters or the entire inferior maxilla becomes necrotic subsequent to the infection of one tooth. This is especially true of children, and we have many cases where the destruction of the inferior maxilla has been great, even though the abscessed teeth have been removed early and every means of drainage has been resorted to. These large areas of necrosis of the inferior maxilla are due to the infection from the teeth getting into the inferior dental canal and blocking off the inferior dental artery which is the chief arterial supply to this part. An infected thrombus or actual destruction of the artery will cause a lowered vitality of the bone, and necrosis of the region supplied by the artery will follow. Thus we may have an abscess starting in the wisdom tooth and under pressure the infection enters the dental canal at this point and occludes the artery. If the pressure is not relieved the infection travels along the canal and in a short time the teeth anterior to the original abscess become devitalized and loosened and necrosis of the bone follows. Bacteriological examination in these cases generally shows a streptococcus infection

which may or may not be accompanied by systemic symptoms.

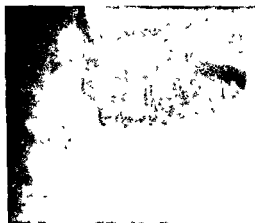


Fig 3 Shows radiograph of operations of curettage of inferior maxilla and loss of entire mandible.



Fig 4

Fig 4 Pathological fracture No history of trauma. Chronic osteomyelitis for months Fracture occurred by biting upon piece of crust

Fig 5 Shows radiograph of inferior maxilla Severe osteomyelitis caused by infection of lower left first molar

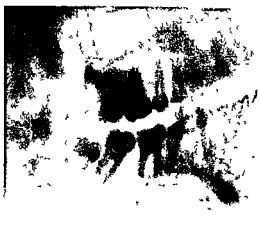


Fig 5

Healthy young boy of 17 Tooth treated by dentist and later an abscess formed which was incised Infection had entered inferior dental canal and had probably destroyed the inferior dental artery Necrosis of one half of the mandible and loss of all teeth resulted

Infected teeth have been overlooked by the surgeon for years, and the so called "gum boil"—which term ought not to be used—has often meant no more than a "cold in the head" The dentist is also responsible for necrosis of the maxilla by his passion for saving teeth—often ones that are badly

diseased Septic dental surgery produces many cases of osteomyelitis of the maxillae, where the mechanical side of the dental surgeon's work appeals to him more than does the pathological problems before him The surgeon in treating these conditions ought to be able to diagnose pulpitis and pericementitis, and ought to be able to recognize vital teeth from devitalized teeth Teeth that are badly broken down and abscessed ought to be extracted at once before they cause abscesses and consecutive necrosis How often do we hear patients say, "My dentist would not extract the tooth until the swelling went down" Does the surgeon delay in operating upon the gangrenous appendix, and does he think twice in incising the tissues and tapping the long bones, in order to obtain drainage in true osteomyelitis? Drainage should be established before the pus is really under tension

The tooth that is infected is generally somewhat loosened in the alveolus, owing to the infiltration of pus into the periodontal membrane and it is painful to percussion in the acute stage If however, the abscess sac has ruptured and the pus has found its way through the alveolar process into the gum

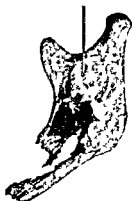


Fig 6 Ramus of mandible removed from child of 6 years Chronic osteomyelitis It took about six months for the sequestrum to form when it was picked out by the writer leaving the periosteum About a year later the patient was seen and one could hardly tell that the ramus had been lost

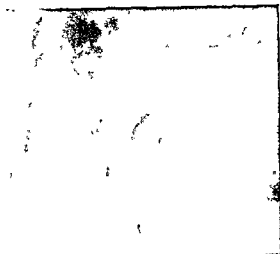


Fig 7

Fig 7 Shows a large area of necrosis extending from ramus to the bicuspid teeth. History of chronic osteomyelitis caused by infected teeth. There were several sinuses which drained into the mouth but no sinus pointing toward face. The large black area is bismuth paste, pumped into the sinus in order to obtain a clear outline of the infected area in the radiographic examination. Cavity



Fig 8

was gently curetted, and periosteum was preserved and bony cavity filled in after several months treatment.

Fig 8 Radiograph showing quite an area of diseased bone although the process had been quite recent. The inferior dental canal has been invaded, the artery has become involved, and the loss of all the teeth on this side resulted.

tissue the pain symptom may be lacking, but a radiograph will make the diagnosis. If the infection has had time to invade the bone the abscess will not be aborted by the extraction of the tooth. In these advanced cases one cannot always make the abscess drain up hill through the tooth alveolus into the mouth but a good free incision should be made along the alveolar process directly over the apex of the infected tooth. If free drainage is not obtained then an incision should be made under the inferior maxilla at the point of fluctuation, parallel with the inferior border of the maxilla. Poultices, salves and other hot applications that are so often applied are the causes of scars upon the face that might have been avoided. Early extraction and free incision inside the mouth generally control the acute condition.

I have not gone into the other causes of necrosis of the inferior maxilla such as fractures, systemic diseases, arsenic and phosphorus.

The treatment of chronic cases of osteomyelitis of the inferior maxilla should consist chiefly in establishing and maintaining good



Fig 9 Young girl age 12 chronic osteomyelitis. The picture shows large sequestrum that is merely held in place by soft tissues the result of abscessed teeth. It took about four months for this necrotic piece of bone to become separated from its periosteum and to be exfoliated.



Fig 10 Radiograph showing large area of bone lost in severe osteomyelitis covering about six months. The inferior dental canal has been split open by the infective process and its contents destroyed. Two devitalized teeth are projecting into the diseased area. Their blood supply and nerve supply have been cut off by the destruction of the inferior dental artery and nerve.

drainage and in free irrigation of this part. Sinuses should be kept opened with iodoform gauze and should be probed frequently to ascertain whether or not necrosed spicular

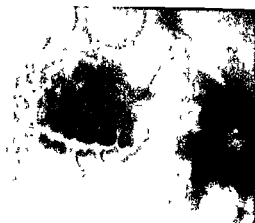


Fig 11 Radiograph showing necrosis involving the alveolar attachment of the molar teeth. Under the first molar can be seen a large piece of necrotic bone which seems to be separated from the rest of the bone by infection. The vitality of both teeth has been destroyed and both were removed when the necrotic area was curetted.

of bone are being thrown off. The surgeon should of course help nature in this process of exfoliation but he should be very careful indeed not to use the curette too vigorously. It is exceedingly easy for him to increase the area of necrosis by traumatizing the delicate new bone cells that are forming in the osteogenetic layer. Nature herself must decide where to draw the line between the necrotic and the living, and it is the surgeon's work to remove the sequestrum when it is formed. This often necessitates incising the soft tissues and a gentle curettage of the infected bone.

BY CLARENCE A. M. WILLIAMS, A. M., M. D.,
F. A. C. S.

The author has recently operated upon two cases of loss of the entire vertical diameter of the horizontal plate of the lower jaw, caused by osteomyelitis. In one the defect was so great that no union between the fragments had occurred while in the second case union took place, after the loss of the bone, with resulting no contact between the upper and lower teeth so that chewing was impossible. In passing the author is convinced that no surgical lesion is so badly treated generally as infection and osteomyelitis of the inferior



Fig 12 Shows profile of young child of six. Marked deformity present caused by loss of bone from chronic osteomyelitis covering a period of about six months. The inferior maxilla has been drawn backward by scar tissue. No mechanical appliance was used to prevent deformity as the child's temporary teeth were not strong enough to attach splint to.



Fig 13 (above) Radiograph of Case 1 See case for description

Fig 15 Bone grafting November 24 1914 Case 1 showing interdental splint

Fig 14 (above) Result of first operation, November 6, 1914 Case 1

Fig 16 After removal of the wires on the fiftieth day, Case 1

maxilla This poor treatment is due, first, to ignorance on the part of the general surgeon as to what the proper treatment should be, and, second to insufficient association of the general surgeon with the dental surgeon As to the proper treatment of early infection and necrosis Dr Dunning has given an outline

of the proper treatment My part of the program consists in describing measures which may be necessary to make up for a loss of bone sufficient to produce proper alignment of the teeth If a fracture occurs in conjunction with active osteomyelitis and necrosis, the upper and lower teeth should be held



Fig. 17 (above) For description see Case 2

Fig. 19 For description see Case 2

Fig. 18 (above) For description see Case 2

Fig. 20 For description see Case 2

in their proper relations by wiring them together, or by some suitable apparatus such as Dr Mitchell will describe. If there results a space between the fragments due to such wiring then one may expect the filling in of a not too large defect by new bone, provided that the periosteum has not been destroyed by the infection or provided that the periosteum has not been injured or re-

moved by too vigorous operative treatment by the general surgeon. In rare instances, for example Case 1 Fig 13 the defect may be too large to fill in, resulting in non union, which may make the grafting of bone into the defect necessary. The customary and wrong treatment of these patients with necrosis is first in too vigorous operative zeal on the part of the surgeon with the

curette and chisel, thus injuring the periosteum; second, in not warning the patient against chewing upon hard objects in order to prevent a fracture taking place, and, third, in not providing the patients with suitable apparatus to prevent a fracture in cases in which the loss of bone has been very great with a consequent great weakening of the lower jaw. If a fracture occurs in association with active necrosis as is frequently the case, or, if the total vertical diameter of the bone necroses away, the fragments are ordinarily allowed to fall together with a resulting deformity, depending on the amount of bone which necroses away. If the amount of bone be small, then the alignment of the teeth may not be seriously disturbed after union has taken place. If, however, the amount of bone lost be considerable, then the disturbance in the alignment or occlusion of the teeth after consolidation has taken place may be so great as to absolutely prevent chewing, as occurred in Case 2. This malocclusion should not be allowed to occur as it is easily prevented by wiring or apparatus.

With proper treatment of the original infection and subsequent necrosis, bone grafting would be practically never necessary. When it seems advisable to bone graft, several requisites must be observed.

First, the proper alignment of the upper and lower teeth must be maintained by suitable means, in my experience the best being the wiring of the upper to the lower teeth.

Second, no bone grafting should be done until all the sinuses are perfectly healed so that no infection remains in the tissues.

Third, all the operative work of grafting must be done from the outside and the mucous membrane of the mouth must not be opened. This is to prevent infection of the graft. If in making a furrow to lodge the graft and also while freshening the fragments, the mucous membrane of the mouth be accidentally opened then at that time one should not insert the graft as it would most certainly be infected and die subsequently. The upper and lower teeth should be held in their proper relations thus preserving the defect intact. The infected wound should



Fig. 21. Rib grafted into defect in the lower jaw.

be allowed to heal before the graft is inserted. In my experience, if the graft is infected from the mouth at the very beginning before the circulation has been established in the graft, it will certainly mean the death of the whole graft. This is not necessarily true of a more or less sluggish infection which comes on late about a wire suture. In such instances of late infection, there may be necrosis of a small portion of the graft, but it need not necessarily entirely die, if it has a good blood supply.

Fourth, the graft should always have periosteum on it and it should be taken from the patient himself who is to be grafted preferably from the tibia. The crest should never be taken as a graft, as this so materially weakens the bone that a fracture of the tibia is liable to occur subsequently.

Fifth, the graft should not be touched by the gloved hand at any stage of the operation. It should be handled entirely by sterile instruments.

Sixth, the general surgeon should have the help and advice of a skillful dental surgeon in these cases of osteomyelitis and necrosis of the inferior maxilla.

CASE 1. Woman, age 33, referred to me by Dr. Crain of Rutland, Vermont, through Dr. Downes, of New York. Her chief complaint was inability

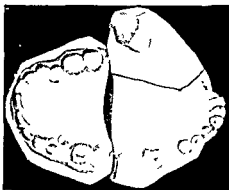


Fig. 22 Model for Case 2



Fig. 23 Hard rubber splint on model

to chew, due to displacement of the lower jaw. Two years ago she had had pneumonia. Four months afterwards two small hard lumps appeared on the under surface of the lower jaw. These were not painful until two months after their onset when she had pain, like a toothache, and both lumps discharged one on the inside and the other on the outside of the mouth. She went to a hospital where during a curetting of the bone, the jaw was accidentally broken. For four months a plaster of Paris bandage was worn and during this time pieces of bone were discharged. Two of them were over an inch long. Bacteriological examination showed that the infecting organism was the pneumococcus. Nine months ago the larger right fragment of the lower jaw was wired to the upper to prevent its displacement inward and backward so that chewing has been impossible. The sinuses have all been healed now for some months.

Physical examination is clearly made out in Figure 13. The horizontal portion of the left lower jaw ends in a triangular point ABC. B is the beginning of the posterior border of the vertical portion of the bone which has been pulled up anteriorly and held immovable in place by adhesions. The right half of the bone ceased at the left canine tooth making the defect about an inch to be filled in. The right half was held in place with regard to the upper jaw by wires so that this was in perfect alignment with the upper teeth. The first operation was undertaken on November 6, 1914. An incision was made in the line of the lower jaw on the outside along the line AB (Fig. 13) great care being exercised to prevent going through the mucous membrane into the mouth. The tissues were very adherent to the bone and they were stripped from the bone with the elevator. The triangular tip ABC was removed (Fig. 13). The next procedure was to mobilize the posterior fragment and to push it posteriorly as it was fixed anteriorly. This was only accomplished after the entire surrounding tissues were stripped from the bone by the elevator on its outer and inner sides extending up as high as the condyle. I feared

for the future blood supply of the bone, but this anxiety was subsequently proved to be needless. The motion even with this extensive separation was not yet free enough, so the coronoid process was divided at its base with a chisel. The motions of the fragment were then perfectly free, showing that the temporomaxillary articulation was uninvolved. The fragment was then sewed in its proper posterior position with chromic gut (Fig. 14) and the skin was closed without drainage. Healing was by primary union. The wires holding the teeth of the upper jaw to those of the lower right fragment were removed at the time of this operation.

The question of the best method of holding the fragments was placed in the hands of Dr. Dunning and Dr. A. E. Mitchell who made an interdental splint (Fig. 15), which held both fragments in their proper relations. Eighteen days after the previous operation, bone grafting, on November 24, was done to fill up the defect (Fig. 15). Great care was taken in making a furrow to lodge the graft that the mouth was not opened. The fingers of an assistant in the mouth was a great help in preventing the opening of the mucous membrane. A graft from the tibia of the requisite length was taken with its periosteum by means of a motor saw. The ends of the fragments of the lower jaw were freshened with the chisel and each was drilled, as well as both ends of the graft. The graft was forced into place between the ends of the fragments and aluminum bronze wires were inserted and twisted and the ends cut off. Wires were used because it was feared that the strain on catgut would be too great. The skin was closed with silk without drainage. A bandage was placed about the lower jaw so as to hold it immovable against the interdental splint and the upper jaw. No part of the wound or the graft was touched by the hands.

A week after the operation a little serous discharge appeared in the front part of the incision and this in a few days became purulent. There was never at any time any temperature. The discharge never amounted to more than three or four drops.

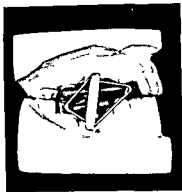


Fig 23



Fig 24



Fig 26

Fig 23 Models showing appliance in position occluded

Fig 26 Models showing appliance in position opened

Fig 24 Models of the mouth showing necrosed area

but it was persistent. On the fiftieth day after the operation using novocaine locally, I removed both wires. The anterior wire was the only one infected but for the sake of safety I removed both, since they had done their work by this time. The graft looked smooth and pink and seemed to be perfectly alive, and was fast in its position. The posterior wire was imbedded tightly in connective tissue and there was no fluid exudate about it. The anterior wire on the contrary was surrounded by granulation tissue and there was some purulent exudate about it and in the meshes of the granulation tissue. Were I to do this same case over again, notwithstanding the infection, I should use wire again rather than catgut, since there was so much pressure on the graft, which had been wedged in, that it would tend to displace the graft. The slight amount of infection I do not think will in-

jure the life of the graft. The wires remained in place long enough to accomplish their purpose to hold the graft in its proper place until it should become fast.

An interdental splint was chosen rather than fixing the right larger fragment against the upper teeth with wires because it was deemed best to form the interdental splint so that it would exert a pressure upon the smaller left fragment, to force it backward. Since the anterior end of the posterior fragment was free, there was a constant tendency for it to be drawn forward by the action of the muscles. It was hoped that the pressure of the splint on the soft parts overlying the fragment in the mouth would overcome this tendency.

A roentgenogram (Fig 16) immediately after the wires were removed (50 days after the grafting), shows that the graft is larger than the original

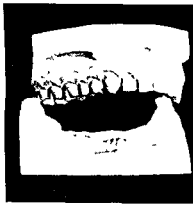


Fig 27



Figs 29 (above) and 30



Fig 28

Fig 27 Models of a mouth showing results of necrosis of lower jaw

Fig 29 Appliance constructed for this case

Fig 30 Same as Figure 29

Fig 28 Section of bone removed (sequestrum)



Fig 31 Patient showing deformity

Fig 32 Patient with appliance in position

graft, due to the proliferation of the periosteum which was cut purposely at the time the graft was taken from the tibia, larger than the bone section itself. When one wishes a graft to increase in size it is advisable that the periosteum be as voluminous as possible. Experience has shown however that when this patient begins to use her jaw in chewing nature will respond to the extra strain on the living graft by causing it to grow to a size necessary to sustain all force put upon it. During this period of increasing growth care must be taken that the force shall be gradually increased and that no sudden great strain be put on the jaw in order that the graft be not fractured.

On March 29 157 days after the grafting the interdental splint was removed and much to our surprise and delight there was found to be great freedom in the motions of the lower jaw, which indicates that a reunion had not occurred in the divided coronoid process. The graft was solidly imbedded in its place. There was no diminution in its size. There was, however a small sinus directly in the center of the graft which exuded a few drops of pus due possibly to a small scale of bone or a fragment of wire.

CASE 2 Woman age 40 admitted to the Prishbyterian Hospital February 1 1915 referred to me by Dr Dunning from the Dental College. One year ago the patient had an alveolar abscess with osteomyelitis of the lower jaw resulting in fracture and necrosis. Dead bone was removed in one of our large hospitals. No attempt was made there to hold the jaw fragments in proper alignment. Consolidation in the position indicated in Figure 17 with great loss of bone of the inferior maxilla. The patient complained that she could not chew solids and was restricted to fluids. The motions of the lower jaw were normal in extent. On closure of the lower jaw it was seen that the lower teeth did not come within almost an inch of touching the upper teeth, being posterior as seen in Figure 18. A roentgenogram (Fig 17) showed that both the horizontal

and vertical plates, as compared to the normal side of the jaw, had disappeared to a very large extent. The vertical diameter of the horizontal plate on the affected side measures one quarter of an inch, whereas on the normal side it measures two inches. The proposition presented was to fracture the horizontal plate, to separate the fragments until the teeth were in proper alignment and to insert a bone graft to fill up the defect. The first thing done was to have an interdental splint made which should hold the teeth after they were placed in their proper position. This was very kindly made by Drs Dunning and Mitchell, and was ready to be inserted after the operation was performed. On February 4, 1915, the bone grafting was done under intrapharyngeal ether anesthesia. Transverse incision was made along the position of the normal lower jaw. This was carried upward to the under surface of the horizontal ramus. The soft parts were carefully separated from the ramus, while an assistant held his finger in the patient's mouth, this being a great help in preventing the accidental opening of the mucous membrane. Practically the whole ramus was separated and the mucous membrane was thought not to have been opened. The ramus was vertically divided with bone-cutting forceps and, using considerable but gradual force, the fragments were separated about an inch by means of a two bladed forceps which was opened by a screw. The interdental splint was then inserted in the mouth by Dr Dunning and this maintained the defect. Some of the horizontal ramus was removed because of its thinness. The defect to be filled in measured just an inch. Using a circular motor saw, an inch piece of the lateral aspect of the tibia was removed with its periosteum cut larger than the bone section, which latter opened the medullary cavity. Both ends of the graft as well as both ends of the fragments were drilled. In the anterior holes a silver wire suture was passed and twisted, Fig 19. In the posterior holes a large sized kangaroo-tendon suture was passed and tied. Perfect alignment of the teeth was secured. Three days after the operation a roentgenogram (Fig 10) showed that the graft at its posterior insertion had become displaced owing to the stretching of the kangaroo tendon. Therefore on the seventh day I reopened the clean wound and wired the fragment.

There was no temperature post operatively but on the tenth day there was a slight discharge from the back part of the wound, and on taking out the stitches there was a discharge of material from the mouth showing that a communication had taken place between the mouth and the graft. On the twenty first day the dead bone graft was removed the interdental splint being left in position to hold the defect open and retain the teeth in alignment.

NOTE.—On May 18 1915 I regrafted the entirely healed lower jaw of this patient, using a graft with periosteum from the tibia and fastening it in place with chromic gut. Perfect primary union resulted.

Case 3 (Fig 21), is added to show the value of the periosteum on a graft. In 55 per cent of my experiments on bone grafting, if the transplant was without the periosteum the graft disappeared. In the following case it was entirely gone in five months.

CASE 3. In November, 1910, I removed half the lower jaw from a lad of 12 for a large giant-cell sarcoma. Fifteen months later I grafted into the defect in the lower jaw a piece of rib which was entirely stripped of its periosteum. One end of the rib was beveled and this was sutured to the freshened edge of the remaining half of the jaw. The wound healed by primary union. Figure 21 shows the rib in position. Five months later, a roentgenogram showed an entire disappearance of the grafted rib. There never was any discharge from the scar.

PROSTHETIC APPLIANCES

BY V. E. MITCHELL, D.D.S.

The many deformities resulting from necrosis of the lower jaw are in most cases preventable, when proper mechanical means are employed, at the proper time.

When a portion of the jaw is lost, either through necrosis or by removal surgically, the remaining fragments or parts are drawn toward each other by the contraction of the muscles, and the teeth are thrown out of occlusion (malocclusion), producing in many cases a great deformity. To prevent this it is necessary to keep the remaining portions of the jaw immobile and in proper alignment by a fixation of the teeth in their normal occlusion. The simplest method is by ligating the teeth of both jaws together with bronze wires.

Angle's gold or German silver fracture bands, fitted to the teeth, with loops on buccal surfaces, which are drawn together with wire ligatures, are very satisfactory in some cases. Interdental splints of hard rubber or metal, cemented to the teeth (when teeth are present) are useful and specially indicated in other cases.

Figure 22 shows the models of the mouth of the second patient, reported above. Figure 23 shows the hard rubber splint on the models that was used in this case. A similar interdental splint was used in the first case and proved very satisfactory, but

the second case did not, owing to lack of cooperation on the part of the patient. In that case I am sure a fixation of the jaws on the good side, by means of bands and wire ligatures, would have given better results. The mandible was severed and the jaw drawn over and forced into the splint before the graft was made. In the first case the splint was worn for five months. In necrosis of the mandible, from whatever cause, when the necrosed portion has been removed or exfoliated and when that portion of the healthy bone which remains is of insufficient strength to withstand the great force of mastication, spontaneous fracture is liable to occur.

To prevent such a condition arising, we should take precautions, and before operating prepare a mechanical device that when inserted will remove most of the strain from the weakened portion of the jaw. The lateral strain being the greatest, it is possible in many cases, while immobilizing the jaw still to allow the one movement, directly up and down; the freedom of the jaw will be of great benefit and comfort to the patient. To show the construction of such an appliance let me describe a case in practice. The idea comes from Germany. An appliance of similar nature was first constructed by Dr Rosenthal.

Miss P. age 28, necrosis of mandible on left side, extending from first bicuspid back to the ramus. X-ray showed a considerable area of necrosis, which after removal would leave a weakened condition of the mandible. It was decided to immobilize the mandible in all directions except directly up and down. To allow this a sliding foot and shoe apparatus was made in this way: gold and platinum bands, thirty two gauge, were made to fit perfectly the right upper cuspid and first molar, and the lower second bicuspid and second molar. These were joined together on their buccal surface by a heavy clasp metal bar and an eighteen gauge wire on their palatal and lingual surfaces. To the upper bar was soldered the shoe, a three sided box in which the foot, a slightly curved bar, would slide when the mouth was opened. The shoe was attached to the upper jaw. The lower jaw could not move forward, nor, from the nature of the appliance, could the jaw be moved laterally.

This appliance was cemented to the teeth a day before the operation. It did not interfere with the work of the surgeon, and was allowed to remain in position for six weeks.

CLINICAL ASPECT OF DISEASE OF THE EXTRAPERITONEAL
APPENDIX VERMIFORMISWITH REPORT OF CASES¹

BY ABRAHAM STRAUSS, M.D., CLEVELAND, OHIO

THE extraperitoneal appendix though not common is not uncommon. Its occurrence has been explained on embryological grounds by the development of the appendix in the left half of the abdomen and its journey to the right iliac fossa (1). Embryologists are agreed that the development is essentially as follows. The primary intestinal loop is straight and just to the left of the midline in the embryo. About the fifth week the small and large intestine become differentiated, as is shown by a swelling in the primary tube. This enlargement becomes the cæcum, and soon can be seen as a diverticulum from this which forms the appendix. Then begins the rotation of the cæcum and colon from left to right. The cæcum crosses at the fourth month and lies immediately below the liver and descends to the right iliac fossa near the end of fetal life. During all this time the mesenterium, as well as other folds of peritoneum, are being formed and turned. Thus it may be readily seen that in transit the appendix has many chances to become fastened to the posterior abdominal wall and have the peritoneum spread over it instead of enveloping it and forming a mesentery. Craig (2) mentions four factors which may influence the position of the appendix.

- 1 The place at which the cæcum stops
 - 2 The relative dilatation of one or more of the walls of the primitive caput coli
 - 3 The resistance the peritoneum offers to its descent
 - 4 The mobility of the parts as influenced by reflections of peritoneum about the ascending colon forming in some cases a very wide mesocolon and in others none
- The last two, of course, bear on the subject, as will be seen from Briggs' classification below.

Briggs (3) names six types of extraperito-

neal appendix, classifying them according to their relation to the posterior cæcum and ascending colon as follows:

- 1 Those lying against the posterior of the cæcum with no mesentery
- 2 Those in which the proximal part only is extraperitoneal, the distal part being free. Holmes (4) reports
- 3 Those in which the proximal part against the cæcum and the rest lies in the large gut extraperitoneally (Thompson, 5)

- 4 Those in which the appendix and posterior surface of cæcum are extraperitoneal (Thompson, 1)

- 5 Like 4, with tip of appendix projecting
- 6 Those in which the tip is extraperitoneal behind the caecal wall, the rest being invested by peritoneum

Wheeler (6) reports an instructive case which may be classed under type 4. His case was that of a cadaver having an appendix six inches long lying to the outer side of the posterior wall of the ascending colon and extraperitoneal. At the end was a fibrous cord continuous with the peritoneum over the front surface of the kidney. His explanation for this position was that a late grade peritonitis had occurred in intra uterine life during the descent of the cæcum and had anchored the tip of the appendix in inflammatory material.

In 200 dissections Ferguson (7) found 17 cases in which the "appendix was so placed and covered by peritoneum that its perforation would open into subperitoneal tissue.

In these cases pus would most likely finally present itself in the situation of a psoas abscess."

Turner (8) reported a study of 105 cases post-mortem which showed the appendix twice completely and four times partially extraperitoneal. He concluded that per-

¹From Mount Sinai Hospital New York City

typhlitis results from appendicitis, and that paratyphlitis results, not from perityphlitis, but from a retroperitoneal phlegmon of an extraperitoneal diseased appendix. This is contrary to Murphy's views (9), namely, that the "appendix is rarely found behind the peritoneum, although retroperitoneal abscesses are not rare, due to perforation and not to malposition of the appendix. Many times it is embedded in the wall of the caecum coli posteriorly, a position always pathologic and never anatomic."

Bryant (10) reports 3 extraperitoneal appendices out of 144 cadavers examined. Stroud (11) found 9 out of 577 cases partially or wholly extraperitoneal. Albrecht (12) shows a picture of one and says the only ones he found in 500 cases were those in which the peritoneum enveloping the appendix was spanned from one ridge to another. Liertz (13) mentions 2 from 300 cases. And Thompson (1) described a post mortem at which he found the terminal portion of ileum, caecum and vermiform process each situated behind the peritoneum in the right iliac fossa. This was one of two cases found in examinations of 25 subjects.

Clinical reports on the other hand, are not so numerous. Briggs (3) reported a case of a girl who had three attacks of appendicular colic. The tip of her appendix was retrocaecal and extraperitoneal.

Springel (14) states that he had one case at operation, and quotes Lennander as having met with an extraperitoneal appendix once at an interval operation and once at an operation for an acute attack. Moynihan (15) refers to it only as a possibility. Kelly (16) shows two beautiful pictures representing a case of Finney's and one of Ellis's.

However the clinical knowledge of appendicitis is not helped from such reports. Bryant (10) stated that "extraperitoneal appendicitis with symptoms of obscure suppuration had been mistaken after the escape of pus for psoas abscess, liver abscess, Pott's disease, malignant disease, and perinephritis." One of Ferguson's (7) cases was a man of forty who died of pneumonia and had had a discharging sinus mistaken for a psoas abscess. "The sinus was found to be ten

inches long and led to a perforated extraperitoneal appendix, in reality a faecal fistula."

The cases reported below fall under three heads:

1. Those presenting a straightforward picture of acute appendicitis (2 cases)
2. Those simulating a perinephric abscess (2 cases), as Bryant mentioned
3. Persistent faecal fistula (1 case), as Ferguson's case

These five cases were operated upon by Dr Edwin Beer, whom I wish to thank for the suggestion and permission to report them.

CASE 1. H. B., No. 486, male, age 50 years. Admitted to the hospital March 2, 1908, discharged March 20, 1908.

Past history, negative.

Present illness. Onset twelve days before admission with severe pain in the lower right quadrant of the abdomen, radiating to the hypogastrium, and lasted four days. During the four days just before admission had slight pain at the site of onset. There was no vomiting, fever, or chill. Bowels regular. No urinary disturbance. Temperature, 98.6° F., on admission rose to 100.4°, pulse 80, respiration 24, urine, negative.

Physical examination. In the outer part of the right iliac fossa about three quarters of an inch above and parallel to Poupart's ligament was a mass two and one half inches long the upper end level with a line from umbilicus to anterior superior spine. Mass firm fixed slightly tender.

Operation, March 3. Appendectomy and drain age for acute appendicitis extraperitoneal. Kammerer incision. In lower part of right iliac fossa and adherent to iliac wall a hard mass was palpated through anterior caecal wall. Caecum adherent to posterior and lateral wall freed and delivered into wound. No appendix could be seen. The above mentioned mass was now felt on outer wall of caecum and posteriorly. Peritoneum over it incised and appendix found coiled up on posterior caecal wall. The tip was buried. Appendix removed retrograde. Tube drain, wound closed in layers. Recovery uneventful.

CASE 2. F. N., No. 150 379 female, single age 20 years. Admitted to the hospital November 20, 1914, discharged December 10, 1914.

Past history. Scarlet fever and smallpox as a child.

Present illness. Onset six days before admission with general abdominal pains, which later became localized in the right lower quadrant. Pains persisted until the day before admission when they became milder, and on that day she vomited twice. Temperature 102° F., pulse 120, respiration, 24, urine, negative.

Physical examination Rigidity and tenderness over right half of abdomen, most marked over McBurney's point

Operation, November 28, 1914 Appendectomy and drainage for acute gangrenous appendicitis with abscess, wholly extraperitoneal. Kammerer incision. Caput coli could not be well drawn up. There was no evidence either of old or of recent intraperitoneal inflammation. No appendix could be seen. A coiled mass was felt to the outer side of and behind the cæcum. The peritoneum was cut transversely at the reflection from the cæcum. This allowed the cæcum to be drawn up into the wound and disclosed the appendix pointing upward with its tip surrounded by an abscess and fastened to iliac fascia over psoas muscle. Appendix removed and a drain inserted. Recovery uneventful.

These two cases are instructive because they illustrate what the operator must expect and look for before he gives up the search and reports a case of congenital absence of the appendix. Neither case had psoas spasm or any unusual sign which would lead one to expect an abnormally placed appendix.

CASE 3 L. C., No 136,025, male, single, age 24 years. Admitted February 1, 1913, died July 6, 1913.

Past history Six months before admission had four attacks of gastro intestinal disturbances and was told he had a gastric ulcer. He was subsequently treated in a Chicago hospital for disease of the right kidney.

Present illness Onset six weeks ago with pain in right iliac region, radiated to the left side of the abdomen. No vomiting, chill, or fever. Lost twelve pounds. Bowels constipated.

Physical examination Patient was pale, thin, and looked sick. In right hypochondrium there was a marked resistance and a ballotable mass that moved with respiration. There was quite some tenderness in the right lumbar region. There were signs of mitral stenosis and insufficiency. Temperature 100.8° to 102.6° F., pulse, 86, respiration, 24.

Operation, February 3. Expecting to drain a perinephric abscess, due in all probability to a diseased appendix, the incision was made over the tender point in the lumbar region. This opened an extraperitoneal abscess in which lay the appendix. This was removed without entering the peritoneal cavity and the wound drained. Actinomycetes were found in the pus.

Repeated urine examinations showed acid reaction and a very faint trace of albumin, occasional hyaline casts, and a few leucocytes, no bile.

March 24. Temperature was greatly remittent. Rigidity and tenderness noted in the right hypochondrium. May 21. Incision and drainage of abdominal abscess through an upper right rectus incision. This abscess was considered extraperitoneal by extension and subhepatic. The patient gradually grew weaker and died July 6.

CASE 4 A. F., No 1,480 X, male, married, age 34. Admitted July 21, 1910, discharged August 31, 1910.

Past history "Nephritis" six years before admission. Typhoid four years before admission.

Present illness Onset four weeks before admission with pain across the abdomen, localizing two days later in the right lower quadrant, where it remained two days, after which the patient was free of pain for one week. Ten days before admission he was again seized with a sharp, constant pain which did not radiate and which he located in the right loin. Six days later he had a similar attack.

Physical examination There was distinct bulging in the right posterior lumbar region with slight redness of the skin and distinct tenderness. A mass could be felt manually.

Temperature, 101° F., pulse, 112, respiration, 41. Urine showed acid albumin, granular casts, and pus cells. Blood count showed 20,000 leucocytes, 90 per cent polymorphonuclears. Cystoscopy negative. On July 23 temperature 100° F., pulse, 108, respiration, 24.

Operation by Dr. Lewisohn consisted of incision and drainage for right perinephric abscess. Large abscess filled with foul smelling pus opened. It was noted that the cavity ran down "toward the appendix region." Kidney was apparently normal. Tube inserted. Four days later a fecal discharge was noticed. July 31. Counter incision in right inguinal region for drainage. August 31. Wound almost closed. Referred to the dispensary for dressings.

On October 27, 1910, the patient was readmitted to the hospital, No 562 IV. Since leaving the hospital he had felt well until two weeks ago, when both sinuses closed. Fever and slight pain in the right iliac fossa followed.

Operation October 31, by Dr. Beer. McBurney incision. Cæcum was firmly bound to posterior abdominal wall. Following the striæ and after incising the parietal peritoneum adjacent to cæcal wall the operator found the appendix, extraperitoneal behind the colon, and adherent in the sinus from the former operation. Appendix removed. Wound drained. A fecal fistula followed, which closed slowly, and patient was discharged well on February 1, 1911.

These cases are examples of the type of appendix that forms an abscess which extends upward and that lies near the kidney, thus presenting the picture of a perinephric abscess. Case 3 also had an extension toward the liver. Lejars (17) mentions a case of prerenal abscess which extended upward to the under surface of the liver, and adds that an abscess may become subphrenic or intrahepatic. He also states that he had two cases of perinephric abscess of appendiceal

origin recognized by the fetid pus. In Case 4 the history was typical of recurrent attacks of appendicitis, and, although the abscess pointed in an unusual place, when such pus is found, and especially when the cavity leads to the site of the appendix, one must not forget the extraperitoneal appendix as the etiological factor. This case also has bearing on the class to follow because it had a persistent faecal fistula, which is another sign to remember after incising an abscess in the lumbar region.

CASE 5. D. McC. No. 119,133, male, age 38. Admitted November 27, 1910; discharged March 12, 1911.

Past history. A year and a half before admission Dr. Beer had operated upon the patient at White Plains for appendicitis. He encountered an abscess and could find no trace of the appendix. Considering it had sloughed away he drained and closed the wound. The patient was discharged from the hospital seven weeks later with a faecal fistula.

Present illness. He entered the hospital because of the sinus and because for the past three weeks he had pollakiuria and pain at the end of micturition. Urine was cloudy. Patient had fever during the last week. Temperature, 99.4° F.; pulse, 80; respiration, 20.

Physical examination was negative except for the scar and very small sinus. There was no discharge. X-ray examination with bismuth in sinus showed only that the sinus ran to the crest of the ilium.

December 4. Temperature rose to 102° F. Urine contained pus and albumin.

Operation, December 7. Old scar excised. Peritoneal cavity opened. Cecum was adherent to anterior and lateral walls. While liberating it the cecum was opened and the hole sutured. No appendix was visible. Then the sinus was traced. It divided one branch leading down toward the bladder, the other leading up and behind the ascending colon. The peritoneal cavity along the outer border of the ascending colon was incised; the colon turned toward the median line, thus exposing the appendix which was amputated. The appendix was perforated at its base. Wound closed with drainage.

This case emphasizes how careful one must be in the search for the appendix before being willing to say it is not there. Like Case 4 and the case of Ferguson it shows that an extraperitoneal appendix left behind after draining an abscess will form a faecal fistula. And finally it teaches how difficult it is to cure such a fistula.

SUMMARY

1. Extraperitoneal position of the appendix is not uncommon.

2. The operator must be on the alert not to miss an extraperitoneal appendix and consider that it has sloughed away or that there was none.

3. Disease of an extraperitoneal appendix may give a straightforward picture of appendicitis.

4. Or it may simulate perinephric abscess or psoas abscess. It may cause a subhepatic abscess or a faecal fistula.

5. Fetid pus obtained from an abscess incised in the right lumbar region should suggest to the operator a diseased extraperitoneal appendix as the etiological factor.

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THE RÔLE OF FAT DEPOSITION IN THE CURE OF ABDOMINAL PTOSIS, INTESTINAL STASIS, AND THE GENERAL ASTHENIC STATE¹

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THE grouping of these three disease entities, to wit: abdominal ptosis, intestinal stasis, and the general asthenic state, is purposely made because the fundamental principles of treatment apply to each. These morbid states are essentially separate and distinct entities in themselves and may exist by themselves through the working of diverse causes, although they so frequently coexist that they have frequently been referred to as synonymous conditions. It is not as easy to define these terms as it is to state and to make use of them. Still, on the other hand, it is not so essential to give a strict scientific meaning to them as it is to give a clinical interpretation which from a practical or clinical standpoint holds true. It is from this viewpoint that the writer has defined these terms both here and in other papers.

Abdominal ptosis is considered a morbid state only when it produces symptoms itself, as in a midline stomach ptosis of marked degree, a true floating kidney, etc. or when it is associated, as is usual with either or both an intestinal stasis and the general asthenic state. Intestinal stasis is likewise considered from a clinical standpoint only and no regard is given to the particular toxic products of intestinal putrefaction or fermentation or to the pathways by which they may affect the human body harmfully. The fact remains that a harmful effect is produced, because when the stasis is removed the effect disappears, and it returns again as soon as the intestinal stagnation returns. This is the interpretation which Lane has given to the term, and it is fundamentally true from a clinician's standpoint, notwithstanding the adverse criticisms which it has received from some pathologists and pathological chemists. This is the interpretation to which the writer, from a clinician's standpoint, has always held in the rather large experience with these

cases, both from a surgical (in conjunction with Dr. Coffey's work) and from a medical point of view.

To define general asthenia or the general asthenic state is still more difficult, but again from a clinical standpoint it is to be separated from neurasthenia, with which it is generally confused. Asthenia means without strength and in a medical sense was first used by Brown in 1780 as opposed to the sthenic state. It has undergone several changes in its significance since then, until the common acceptance of its meaning has been that of neurasthenia. General asthenia and neurasthenia are looked upon by most physicians today as being synonymous states, and have been treated quite generally along the principles laid down by Weir Mitchell and developed by his followers, especially DuBois, Déjerine, and Marie. But general asthenia is essentially a physical state, it has fundamentally nothing to do with disturbances of the psychic mind, which is the basis of neurasthenia. It is characterized by a general slowness of all mental and physical movements, the impossibility of all excesses; but on the other hand it is characterized by the ability of the individual to overcome by force of his will power this body weakness of which he is at all times conscious. The clinical picture of the general asthenic is different from that of the neurasthenic. The patient has the attitude of listlessness and general body weakness. In marked contrast to the ordinary neurasthenic who relates with enthusiasm the manifold details of his illness, this patient states his history only by the aid of close questioning. He is psychically balanced and, also, when not too discouraged, will show a grim determination to overcome what he recognizes as the weakness of his body by force of will power. This attitude the neurasthenic never manifests. Let there enter into the above

¹ An address before the Spokane Medical Society, Spokane, Washington, December 1, 1904.

picture disturbances of a psychic nature and the patient will take on the traits of both conditions. This combination of the essentially physical with the essentially psychical, however, is on the other hand not so frequently met with as one would at first glance believe.

Let one stop here and ask what is the cause of the general asthenic state, and immediately one is engulfed in a maze of developmental and pathological facts and fancies, the true interpretations of which no one as yet knows. From our clinical experience we can safely say that the general asthenic state may be both acquired and in a sense congenital. Acquired in the adult by reason of a tuberculous infection, a pernicious anemia, frequent childbearing. I have reported typical examples of the general asthenic state in adults of broad frame and without ptosis, the result of intestinal stasis due to right sided pericolicitis. In the latter cases the congenital factor did not enter at all and yet the general asthenic state of the individuals was as marked as ever seen in the congenitally ptotic type of Stillers.

The majority of general asthenics do belong to Stillers' *asthenia universalis congenita*, a type characterized by the slender, gracile, bony frame emphasized by Goldthwait the straightened pelvic basin first described by Walkow and Delitzin and later by Coffey, and the congenital mesenteric malformations emphasized by Coffey and the writer in previous publications. But what underlies the development of the asthenic type on the one hand and the asthenic state on the other? The asthenic type exists in healthy young children and may easily be recognized. Albu found ptosis in the newborn in 27 per cent of the female and 4 per cent of the male children, and in children below the age of puberty he found 44 per cent of ptosis in females and 11 per cent in males. Children usually do not develop the general asthenic state, however, until after puberty when the body rapidly lengthens, and we may say also when chronic intestinal stasis most frequently makes its appearance. The asthenic type fundamentally is in all probability an inherited type of body structure passed on from parent to child.

The inheritance of the acquired narrow waist, and the effect of the fashionable "gradual decline" into which the ladies of the time of Louis XIV entered so willingly, may be present today in their descendants. There is a racial as well as a family tendency to this body type. There is no doubt that the extreme ptotic type found in the British and French is not found frequently in the Germans, and this explains the general lack of interest and understanding of the subject among German physicians. Incidentally the work of Professor Rovsing of Copenhagen has done more in the past two years to emphasize the importance of this field of work on the Continent than that of any other, and it has done much to offset the antagonism to Lane's extreme views.

The development of the general asthenic state in the person of the general asthenic type of build, it has seemed to me, is to be explained most logically by reason of certain ill-defined morbid states produced as a result of the asthenic body formation, which morbid states assist, in the way of a vicious circle, in exaggerating the anatomical changes during the time when the child is developing into the adult. I say as a result of the body formation, and not coincidental with it, because the asthenically built child by proper physical training and attention to bowel function need never develop an asthenic state, although he must retain his general body build. He simply prevents the occurrence of those factors which lead to the asthenic state if allowed to develop. Again, if this is not true how can an individual with a well-developed general asthenia be cured of it and be taught how to prevent its return if it is not simply an acquired state the result of the congenital body build, and not an inherited character itself? Our experience has led us to believe that theoretically every case of general asthenia can be cured and be taught the principles upon which a lasting cure depends, and yet the type of body build is not fundamentally changed at all, it is simply in a measure remodeled. Again I do not believe that the asthenic state can be an inherited state, because in the non-asthenically built adult it can be reproduced typically in all of its

phases by a mechanically produced intestinal stasis, such as has resulted in our experience from a severe right-sided pericolicitis, which, when relieved, has permitted again the complete relief of the general asthenia

What the factors are that produce the general asthenic state and how they produce it is impossible for one to state. They may be wholly of the nature of chronic intoxications, as Lane has assumed; and this is borne out by the appearance of a severe asthenia from intestinal stasis in those individuals in whom ptoses do not exist, in chronic infectious diseases in Addison's disease, pernicious anemia, etc. It may depend possibly upon interference with the function of the ductless glands. For instance, it may be due to a disturbed balance between the sympathicotrophic and the vagotropic functions of the adrenals operating through or upon the autonomic nervous system. In fact there is a striking resemblance between certain severe pigmented, toxic types of intestinal stasis and Addison's disease, which is known to be associated with an atrophy of the adrenal glands. The mechanical traction upon blood-vessels and the nerve-filaments of the autonomic nervous system produced by prolapsed viscera in a subject largely devoid of intra-abdominal fat may have its influence in the production of the general asthenia, although this factor could not well operate in the individual who has no visceral prolapse.

Some four years ago my work with patients suffering with general asthenia and the effects of abdominal ptosis and stasis led me to correlate the diverse factors of their treatment into four fundamental principles. The close observation of my earlier cases and the experience gained with others since then has made me more and more convinced that these principles are truly fundamental. They are briefly as follows:

1. The absolute regulation of the bowel, i.e., the relief of stasis, by dietetic and postural methods alone. This includes the removal of all surgical barriers (for the most part irrelievable duodenal, ileal, or cæcal stasis which is mainly due to bands, extreme mobile cæcum, extreme midline ptosis, and

extreme matting due to pericolicitis). These surgical barriers are found in somewhat less than ten per cent of all patients seeking relief from their symptoms.

2. The deposition of extraperitoneal fat.

3. The remodeling and physical development of the body. The expanding of the upper abdominal and lower chest cavities, and the correction of postural strains and faulty postures, are best carried out along the lines first systematically taught by Goldthwait. With these procedures well under way the patient must be carried through a long course of physical training which has for its object the gaining of general body tone. This part, when possible, should be supervised by a competent physical instructor and should be diligently persevered with over a period of months.

4. Fixation of body habit. The fixation of the body habit means simply the overcoming of the general asthenic state. It requires from one to two years of sufficient body weight, of normal bowel function, and systematic physical training to produce a permanent end-result. The patient must be educated in these various principles and be persuaded to carry them out to the end. It is necessary to appreciate the fact that there must be a perfect harmonizing of all of these principles in order to obtain an end-result. The failure to obtain any one principle will result in general failure. There are, however, only two factors which are really encountered that produce this failure, namely, the finding of a surgical barrier to the relief of stasis, which the patient does not choose to have relieved surgically, and, secondly, associated psychical disturbances that cannot be removed and which prevent control. It is important to emphasize in passing that the mere removal of a surgical barrier will seldom if ever bring about a cure, it is only one factor of a general plan; and it is the lack of understanding of this general plan on the part of many surgeons which has brought conservative surgical procedures for the relief of these barriers into undeserved disrepute. The removal of the barrier surgically merely places the patient in a condition where he can be cured medically.

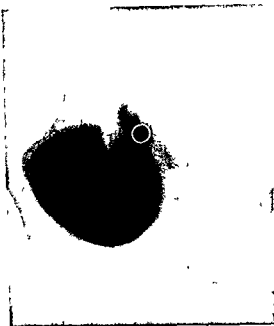


Fig 1

Figs 1 and 1a Illustrating the effect of fattening on the position and size of the stomach Case of



Fig 1a

a young woman who gained thirty pounds in six weeks

In the handling of asthenic ptotic patients by the above principles of treatment there are two very striking results observed clinically. The dilated atonic stomach is converted into a contracted tonic organ. There is frequently a six-hour rest in the former by reason of its prolapsed position and its weak peristaltic waves. Whether its position is altered or not by the fattening, the stomach becomes noticeably contracted in size, and deep, vigorous peristaltic waves empty it in normal manner. Overloading the dilated asthenic stomach with food never dilates it further, unless there is organic narrowing of the outlet, it restores its tonicity. This fact is fundamentally opposed to the teachings of all standard authorities on diseases of the stomach. Ewald, Boas, Zweig, Cohnheim, Bassler, Kemp and others, all teach essentially the same principles, namely, small meals, frequently given, in the horizontal position. These principles are wrong. Feeding should be forced to the limit of endurance with a mixed diet of high calory content. The position is quite immaterial,

although the training of a patient in the art of overfeeding is best started in bed where the attending distress may be relieved by heat, massage, etc. X-ray examinations made in series at intervals of a few days show that the tone and contraction of the stomach begins early in the course of forced feeding, before there is appreciable general body tone acquired. This also is contrary to the usual teachings.

The second result noted clinically is the fact that elevation of the stomach and colon does not always occur with fattening and that this elevation is not necessary to insure a permanently good end-result. The cases group themselves at a ratio of about nine to one into those cases where direct elevation of the stomach and colon is marked, and those where little or no elevation is obtained. This difference is noted well in the accompanying pictures. What underlies the difference in response we have not yet had an opportunity to determine. We do not believe it to be due often to adhesions holding down the omentum or transverse colon, for



Fig 2

Figs 2 and 2a. These radiographs show the same effect as in Figs 1 and 1a. Addition of 35 pounds in six



Fig 2a

weeks. Both patients remain in perfect health after one and one half years.



Fig 3

Figs 3 and 3a. Illustrating type of case in which elevation of stomach and colon does not take place after fattening. Stomach, however, becomes tonic. Young



Fig 3a

woman. Weight increased from 115 to 154 pounds. Fig 3a was taken 15 months after Fig 3. End results after two years perfect.



Fig 4

Figs 4 and 4a Same type as case shown in Figs 3 and 3a The patient was a young woman End result



Fig 4a

perfect after one year Forty pounds in weight added

the reason that most of our cases of this group have been perfectly free from radiographic evidence of such binding. We are rather of the opinion that the fixation of the mesocolons is nearer the median line than usual or that possibly a non-obliteration of the omental bursa exists which permits of the permanent low position of the colon. In a few cases there has resulted marked elevation of the viscera in the presence of definite surgical barriers, which have prevented the relief of symptoms and caused general failure of an end-result. In one such case (H S) there exists an irrelievable mobile cæcum with a moderate ileal stasis, although the anatomical improvement is marked. This case must be treated surgically if an end-result is obtained. In a second case, with severe asthenia and ptosis, with pain and vomiting due to duodenal stasis, a marked anatomical result was obtained without relief and at operation a band across the lower portion of the duodenum was found to be the

cause of the trouble, as removal was attended with relief from the distress. As a rule it is not possible to add much weight or overcome the asthenic state in cases in which a surgical barrier exists, because the forced feeding soon brings about a violent upset with vomiting which does not permit further feeding. It is the recognition of this fact which has given us our surest means of differentiating surgical from medical cases.

The effect of fattening upon the cæcum is minimal. Mobile cæcum exists in two forms: first, where it occurs as a part of a general abdominal ptosis, in which at least the hepatic flexure has markedly fallen and where a distinct mesocolon with a median point of fixation exists, and secondly, the so-called true mobile cæcum of Wilms. The latter form is an elongated, usually dilated cæcum which lies over the brim into the cavity of the pelvis. It possesses no mesocolon and the ascending colon occupies its normal place on the inclined plane that forms the floor of the



Fig. 5

Figs. 5 and 5a. Illustrates the rather rare case in which the mechanical effects of fattening may be obtained in the presence of a mild surgical barrier. Young man with



Fig. 5a

gain of 40 pounds in which a periodically irremediable ileum stasis, believed to be due to bands, caused a failure of cure, four months after forced feeding

kidney niche, and its peritoneum is fused normally with that of the parietal wall. In the former condition fattening will usually cause some elevation of the cæcum as shown in the picture of Miss R. Most of these cases are amenable to dietetic treatment, i.e., the cæcal stasis can be overcome. In the true form of mobile cæcum however, or in the other form when bound by adhesions, the stasis usually cannot be overcome and the case must be treated surgically.

The theme of this paper concerns essentially the second principle in the above general plan of treatment, namely, the part played by the deposition of fat. Inasmuch as the morbid states of fat metabolism or of tissue injury cannot enter into this plan of body up-building, the storing of fat has to do with the increase of the normal adipose tissue. In nearly all parts of the body the ordinary areolar tissue contains a variable quantity of fat tissue. Its distribution is not uniform, for in some parts it is collected in great abund-

ance, as in the subcutaneous and subperitoneal tissues, the bone marrow, and the liver. When the fat tissue is forcibly increased it collects for the most part in these locations, and is the direct result of the forced nutrition. The function of it, therefore, is essentially a physiological one, namely, a storehouse for excess body nutrition. But because the localization of it is largely within the abdominal cavity it serves a second important function which is purely mechanical.

When an undernourished ptotic patient in bed is rapidly force fed, there is a progressive and corresponding gain in weight due largely to addition of fat to the body. The patient does not become materially stronger nor add to his reserve strength. He is distinctly fat and flabby. But during the first week or two of the fattening process there are marked radiographic changes which take place in the abdomen. The kidneys, stomach and transverse colon become in the majority of cases rapidly elevated, and



Fig. 6

Figs. 6 and 6a. Illustrating type of mobile caecum which is elevated somewhat by fattening, and in which a caecum



Fig. 6a

stasis is relievable. Young woman. Addition of 20 pounds and complete end result after one year.

the dilated atonic stomach becomes normally contracted. The work of different observers has proved the existence of a constant but variable degree of intra abdominal pressure. Whenever the general visceral mass is increased the intra abdominal pressure is increased, other things being equal, in proportion to such increase of visceral mass, and as fat largely increases the visceral mass the increase of pressure is due to it. We have often noticed radiographically that as the fat is stored in the abdomen there is a corresponding reduction in the size of the atonic stomach. This has led to the belief that possibly the size of the stomach is directly influenced by the hydrostatic pressure within the abdomen, that is the lower the pressure the larger the stomach and the more gases within it, and vice versa. I cannot believe this is wholly true because the element of muscle tone enters as soon as forced feeding is instituted by reason of the increased nutrition and the increased muscular work demanded of the muscular coats of the stom-

ach. However, we do believe that this general visceral elevation and the overcoming of the atonic stomach does occur in the majority of instances before there is any appreciable increase in general body tone. The latter begins noticeably to appear only after physical exercising has been started, and also the amount of visceral elevation or the amount of stomach tone acquired does not increase very much by the subsequent overcoming of the general asthenic state. These points are well illustrated in the accompanying pictures.

The increase of intra abdominal pressure and the building of the fat cushions chiefly about the kidney niches and the lower abdominal and pelvic walls which narrow the outlet, or the downward pointed cone of the abdominal cavity, probably is the greatest single factor in the mechanical elevation of the viscera. It has seemed to me, however, that a direct shortening of the mesenteries takes place also by the growth of the fat tissue within them. If a mesentery is largely



Fig. 7

Figs. 7 and 7a Illustrating type of mobile caecum (in this case bound by bands) without elevation of caecum



Fig. 7a

and with irrelevable caecum stasis and failure of end result



Fig. 8 Illustrating Case 2



Fig. 8a Illustrating Case 2

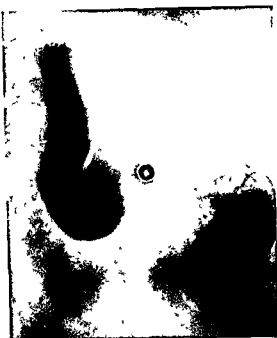


Fig. 9. Illustrating Case 1



Fig. 9a. Illustrating Case 3

devoid of fat it is reasonable to suppose that it would be somewhat longer than if it were liberally filled with fat cells for the reason the mesentery is essentially a non elastic connective tissue structure. Dr. Sears has repeatedly observed the fact radiographically that the stomach and colon in the patient before fattening can be raised with the hand high in the abdomen, and when the pressure is released they immediately fall to the bottom of the cavity. After fattening, these organs, which now occupy a higher level in the abdomen, can also be raised practically as high as before, but on releasing the pressure they fall suddenly to their new level and stop there. They stop abruptly as one would expect them to do if they were supported by a loose ligament. Direct measurements, however, bearing on this supposition cannot be given at this time, so that it can only be assumed. The extreme elevation of the stomach and transverse colon sometimes seen radiographically, also lends favor to such a view. The occasional observation as mentioned above, that the stomach and colon are not elevated at all

although there is an increase of the general visceral mass, increased tone of the anterior abdominal muscles, a decrease in size of the lower abdominal cavity, relief of the atonic stomach, and the acquiring of just as good a functional end-result as in the other cases, adds an interesting quandary to the whole subject. It is probable, however, that in such cases definite developmental mesenteric defects exist which counterbalance the effect of the other factors.

There are other logical results which may rightly be ascribed to the beneficent effect of the extraperitoneal growth of fat. In testinal stasis is more easily overcome by reason of the increase of the visceral mass and the elevation of the viscera, probably for two reasons, first, there is a general increase in the tone of the bowel musculature, and second, there may be definite relief of mechanical barriers -- a duodenal or an ileal stasis for instance. The support of the autonomic nervous system through the relief of the effects of stasis or the relief of mechanical drags must have some influence. The tender spastic colon as a rule progressively disappears as



Fig. 10 Illustrating Case 4

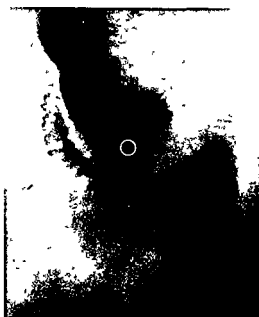


Fig. 10a Illustrating Case 4

fat is added to the abdomen, that is, before there is an appreciable increase of general body tone

An analysis of the physiological factor of fat deposition, i.e., of increased general body nutrition, is from a practical standpoint of easier interpretation. It affords the foundation for the development of general body tone by means of suitable physical training. Exercising without the preliminary foundation of excess nutrition always results harmfully. This factor is the basis of the fourth principle of treatment enumerated above, which makes possible the ultimate overcoming of the general asthenic state. It adds body tone generally and locally. It supports the autonomic nervous system and the ductless glands which surely play a vital influence in the development and maintenance of body health.

In closing I wish to refer briefly in a comparative way to the position which this plan of therapy occupies in relation to the well-recognized so called Weir Mitchell rest cure. As intended by its author, this was essentially a rest cure for psychically imbalanced patients,

for it consisted of absolute bed rest and isolation, together with various adjuncts, such as forced feeding with milk and the conserving of muscular strength by means of massage and faradization. But because of the numerous failures met with in its employment many physicians began to modify it in this way and that to meet, as they believed, individual requirements. Indeed, so numerous have these modifications become that the sections on the treatment of neurasthenia found in most of the standard textbooks on general medicine contain oftentimes a medley of opposing therapeutic principles. DuBois and Déjerine have made of it essentially a treatment of psychotherapy under the favorable conditions of rest, isolation, and overfeeding. From the standpoint of the psychically disturbed patient this is surely logical and correct. The Germans, on the other hand, have laid most stress upon the fattening process or *Mastkur*, as they call it, which is, it seems to us illogical for both the psychically and the physically weak patient, for the former can neither be reeducated psychically, nor the latter be made physically

strong, by means of it. It has been our belief, a belief which has come to us by reason of our experience with patients, some of whom had been under the care oftentimes of very prominent neurologists and psychotherapists, without relief, that these failures have been due to the lack of differentiation between the psychically weak or neurasthenic patient and the physically weak or general asthenic patient. Our work has been for the most part with the latter group of individuals, because we have drawn them from the ranks of the general ptotics and those suffering from intestinal stasis. Psychical disturbances in these patients play distinctly a secondary rôle; in no sense are they to be considered psychasthenics. As soon as the toxic symptoms due to the stasis are relieved their nervous symptoms disappear of themselves and cease to give trouble, unless there is present a fundamental psychic disturbance, which fortunately is not very common.

To emphasize what has just been stated I take the liberty of citing briefly four illustrative cases, all of which have been at one time or another under the care of very prominent physicians, in this country or abroad, who failed to distinguish the physical from the psychical foundation of their ill health.

Four years ago Mrs. S., a widow of 61, suffered with the toxic symptoms of an extreme intestinal stasis, extreme headaches, body weakness, a weight of 87 pounds. This condition had existed for over forty years. Twice during the past ten years she had undergone protracted rest cures under a prominent Chicago internist, without result. For four years she has applied the above outlined principles with the result that her bowel is regulated, her headaches gone, she is stronger than she was at thirty-five, and her weight is around 130 pounds. Last spring she suffered a very severe influenzal infection which lighted up an old tuberculous infection of the lung, which at present seems to be becoming arrested.

Miss L., age 18, was a normal, healthy child until 14, when seemingly a ptomaine poisoning set up a chronic dysentery. She ceased to develop phys-

ically, became weak, with dry, pigmented skin. During the past four years she has consulted many physicians throughout the East. For the past year she was under the care of a prominent Chicago neurologist. Behind her dysentery was found an ileum stasis which we thought was due to bands, but it responded to dietetic measures and the girl rapidly gained from 74 to more than 100 pounds, her upper abdomen was expanded between four and five inches, and she is now continuously in school for the first time in four years. Her pictures show a really marked anatomical result. Her end result in time is perfectly assured.

Mr. B., age 32, is a business man, who has been from early childhood a general asthenic. He had nervous breakdowns in school and later in his business life. For the past four years he has practically been unable to attend to his affairs because of head aches, dullness, and lack of strength and efficiency, he is generally constipated. During the summer he was advised by his physician, a neurologist of San Francisco, to set aside one more year in which to become rested and strong. His examinations showed a general ptosis with a general colon stasis of 96 hours, the chemistry of digestion was normal. He has since gained in weight from 137 to 170 pounds, his upper abdomen has expanded about six inches, his headaches are gone and he can box five three-minute rounds at a hard pace without tiring. His accompanying pictures likewise show a good anatomical result.

Miss Z., age 28, has always been from childhood frail, nervous, and morose. Two years ago she was taken to one of the foremost psychotherapists in Europe who considered her a psychically imbalanced patient. She did not remain long under his care, but entered a sanatorium in Germany, where she underwent a *Mastkur*. She was severely upset by the forced feeding as conducted there and did not recover for several weeks, when she was advised by her physician not to continue with it. I had examined this patient before she went to Europe, she in fact had prints of her radiographic examinations with her and showed them to the physicians consulted, but I feared the psychical element in her case and did not urge treatment under control at that time. More recently she has been treated in hospital, has gained twenty five pounds in weight, has lost her nervousness and moroseness and is now taking up the more vigorous plan of physical training under the special physical director. Her anatomical result as shown radiographically is very marked.

ELEPHANTIASIS¹

By L. L. HILL, M.D., LL.D., F.A.C.S., MONTGOMERY, ALABAMA

Visiting Surgeon Laura Hill Hospital

IN a paper that I published in the *Medical News* of Philadelphia, in 1894, I made the statement that elephantiasis was by no means a surgical curiosity among the negro race in this so called "black belt" of Alabama. Twenty-one years of subsequent active surgical practice has not caused me to change my opinion. Elephantiasis is more common in adult life. It occurs three times as often among men as among women. Damp, malarious regions and bad hygienic surroundings, common conditions with the negro race here on cotton plantations, are important predisposing influences. Interference with lymphatic and venous currents, followed by a streptococcal infection, produces an obstructive lymphangitis which results in an œdema rich in active leucocytes, which, according to Robinson, not only become connective-tissue corpuscles, but also induce a hyperplasia of the fixed cells already present, producing a hardening and thickening of the skin with general connective-tissue hypertrophy and increased vascularity, but with muscular wasting. Without the erysipelatous infection there can be no fibromatous process, which is "the histological essential of elephantiasis."

Sabouraud is decidedly of the opinion that no morphological or clinical distinction can be made between the germ of this infection and Fehleisen's streptococcus, the streptococcus of erysipelas. One characteristic, however, is its tendency to remain in the obstructed zone and not migrate. Sir Patrick Manson says lymph stasis alone does not produce elephantiasis and has demonstrated the truth of his assertion by experimental ligation of lymphatic trunks. The obstruction may be congenital or due to filaria sanguinis hominis, cicatricial contractions, tumors, or tuberculous, syphilitic or carcinomatous infiltration. It has been shown by Matas that the prevalence of elephantiasis in the tropics is due, not so much as was formerly believed to the initiative of filaria sanguinis hominis

but to exposure of the skin to injuries, irritants, insects, and frequency of eruptive diseases, all of which tend toward lymph stasis and dermal infection.

Though the parasite was discovered by Bancroft of Brisbane in 1876, to Sir Patrick Manson is due the credit of demonstrating that the mosquito was the intermediary host and man its definitive and the initiative connection of this snakelike organism in the production of elephantiasis. The parental worms and their premature products of conception are dangerous, but the fully formed microfilarie, which are about the diameter of the red blood-corpuscles, circulate freely and are without any deleterious effect.

The examination of the blood should be made at midnight, as the microfilarie begin to enter the peripheral circulation at six in the evening and, like the *dansesuses* in a peacock alley, increase until twelve. Sir Patrick Manson explains this filarial periodicity by saying "This night swarming of the larvæ of *F. bancrofti* in the peripheral circulation seems to be an adaptation correlated to the life habits of its liberating agent, the mosquito, *Culex fatigans*, its usual intermediary host." In elephantiasis the enlargement of the affected part is steadily progressive and often reaches enormous proportions. The skin is coarse, darker than natural, and eczematous. Ulceration not infrequently occurs. The decomposition of the elephantoid discharges is very offensive. The elephantiasic fever is usually preceded by a rigor and I have seen the temperature reach 106° F. Its subsequent course is similar to the remittent type of malarial fever, differing, however, in that the fever is of greater severity. It usually continues about a week. Locally there is a distinct erysipelatous blush, with great tenderness. A milky exudation is often present. Such an attack is usually followed by a calm, which may last from a couple of weeks to several months, when there is another outburst, always leav-

¹ Read before the Medical Association of the State of Alabama, Birmingham, Alabama, April 22, 1915.

ing the part larger than before. In elephantiasis scroti the spermatic cord may become involved to the extent of dilating the abdominal ring, so that upon the subsidence of the swelling a hernia occurs.

The prognosis, so far as the life of the patient is concerned, is always very favorable, especially in this country, but the patient may be rendered miserable by the immensity of the growth, which sometimes weighs more than one hundred pounds.

Treatment. During the elephantiasic fever, give a saline purge or aperient along with sleep producing drugs, such as morphine, aspirin, and sulfonal. Locally, there is nothing better than elevating the part and applying lead water and laudanum or a solution of the acetate of alum. The daily injection of fibrolysin, as recommended by Castellani, has been disappointing. Ligating the femoral artery to starve the growth, as was first performed by Carnochan of New York, in 1851, has fallen into merited disrepute. In 1908, Handley of England, by means of threads of unabsorbable silk attempted to drain the obstructed areas into neighboring normal tissue, but two years subsequently he said, "To my mind lymphangioplasty has failed to establish its position in the treatment of elephantiasis." The principle of the operations of Lanz, Okel, and Rosanow is the establishment of a drain from the obstructed lymphatic area through the deep aponeuroses to the normal infra aponeurotic lymph channels. To the attainment of this end an operation recently devised by Kondoleon of Greece is far preferable, thus I will describe in the report of one of my cases.

My clinical experience with this disease is limited to ten cases and, as most of them have already been reported, I will at this time confine my remarks to two recent ones that seem to me to be of especial interest.

CASE 1. T S, forty three years of age. I made a very extensive dissection of the lymphatic glands of the groin, which was followed by a slight enlargement of the penis and scrotum but it was not progressive and his general health was perfect until six years later when he had an attack of elephantiasic fever. The penis and scrotum rapidly increased in size until the former was nine inches and the latter twenty inches in circumference. I

advised an operation, to which he readily consented. I made perpendicular incisions from the external abdominal rings and dissected out the testes and cords from the back of the scrotum, where they were imbedded in "a mass of lax, blubbery, dropsical areolar tissue." Turning the testicles and the "sacred highway so essential to the perpetuity of the race" upon the abdomen, I esmarched the scrotum and removed it practically in its entirety with the loss of very little blood. Bringing the organs into position I covered them with the adjacent skin and, in the extensive loosening up, I was careful to expose as much as possible the deep muscular lymph spaces. Upon the dorsal surface an incision was made the whole length of the penis, and the penis freed of its covering. A very extensive dissection of the skin over the pubes enabled me to sew the pubic skin to the mucous membrane of the glans and it practically covered the organ. The wound healed readily, retains its reach when in action, and the owner says it is more than satisfactory. A few weeks after leaving the hospital the patient had a very mild attack of elephantiasic fever, soon followed by another. Dr Charles M Franklin and I gave him thirty-two injections of polyvalent antistreptococcic serum in doses of 10 ccm at intervals of forty eight hours, as recommended by Matas. It has now been several months since the last injection and Dr Franklin has had him under constant observation and reports that he is attending to his professional duties and that his health is excellent.

CASE 2. R J, negro about forty years of age was referred to me by Dr Joe McClendon of Dadeville, Alabama. He had a typical case of elephantiasis of the left leg. It is no exaggeration to say that it was eight times as large as the right leg. I advised Kondoleon's operation. Making an incision from the external malleolus to the external condyle of the femur extending through the aponeurosis to the normal muscle tissue a strip of the "edematous subcutaneous cellulose adipose layer" three inches in width was removed the entire length of the wound. Turning back the aponeurosis for three inches, stitching the edges to the muscle the length of the wound, a direct communication was established between the supra aponeurotic and the subaponeurotic lymph spaces, a distance of three inches in breadth, the entire length of the leg. This procedure was repeated upon the tibial side. In three weeks there was an appreciable shrinkage and Dr McClendon reports four months after the operation "His leg from the ankle up is doing exceedingly well, but on top of his foot and around his ankle there is a band of elephantiasis. The negro says he feels perfectly well and is able to do good work."

In closing this paper I cannot refrain from acknowledging my indebtedness for many facts to that distinguished American surgeon, Rudolph Matas.

A STUDY OF THE RELATION BETWEEN THE DEGREE OF MENSTRUAL REACTION IN THE ENDOMETRIUM AND THE CLINICAL CHARACTER OF MENSTRUATION¹

By I MIL NOVAK, A B, M D, F A C S, BALTIMORE, MARYLAND

From the Gynecological Department and the Laboratory of Gynecological Pathology of the Johns Hopkins Hospital

THE material which forms the basis of this study was obtained from a rather large series of cases in the gynecological department of the Johns Hopkins Hospital. At the very outset I wish to express my appreciation of the courtesy of Dr Howard A. Kelly, head of the department, in placing at my disposal the wealth of material furnished by his clinic, and my very great obligation to Dr Thomas S. Cullen, associate professor of gynecology and director of the laboratory, for his kindly and invaluable supervision of this work.

The point of departure in all present-day work upon the menstrual histology of the endometrium must necessarily be the epoch-making studies of Hirschmann and Adler (1), published in 1908. Whether they are to be given entire credit for thus revolutionizing our knowledge of this subject or whether, as some maintain, this is in part due to earlier investigators (Westphalen, Kundrat, and Engelman), there can certainly be no question that to the two Vienna investigators belongs the honor of popularizing this teaching to such an extent that it now forms the basis of all histologic investigation of the endometrium. The principles arrived at by their studies are so well known that only the briefest possible mention is necessary at this time.

It will be recalled that Hirschmann and Adler were able to demonstrate quite clearly that the uterine mucosa undergoes a cyclical histological change which corresponds to the clinical cycle of menstruation. This developmental cycle in the endometrium they divide into four stages, as follows:

The post menstrual stage, embracing the few days immediately following menstruation. During the latter it seems as if the endometrium empties itself, as it were, so that during the post menstrual period its

glands are narrow, collapsed, and straight, while the stroma is rather firm and compact (Fig. 1).

The intercal stage is the term applied to the long period between the termination of the preceding stage and the beginning of the premenstrual phase, next to be described. During this period the endometrium is undergoing a steady but gradual development, the glands becoming fuller and exhibiting gradually increasing convolution. The stroma is still quite compact in appearance.

The premenstrual stage begins from a few days to a week or more before the next menstruation. At this time according to Hirschmann and Adler, there is a sudden increase in the hypertrophic development of the endometrium. The lumina of the glands become much increased, presenting a characteristic scalloping on cross-section, while in longitudinal section they exhibit a dentate appearance (*sägeförmige Drüsen*). In very marked cases there is a strong resemblance to the glands of early pregnancy (Fig. 2). The epithelium undergoes mucoid change, often appearing low and shreddy. The stroma cells participate in the general process of development and in exaggerated instances may show such a protoplasmic increase as to simulate very closely ordinary decidual cells. More frequently, however, there is only a suggestion of this change, the cells being of a transitional type (*decidualähnliche Zellen* or *Übergangs Zellen*).

The menstrual stage corresponding to the actual existence of menstruation, is characterized microscopically by appearances which are to be looked upon as a transition from those of the premenstrual period to those of the post menstrual phase. In addition to the vascular phenomena characteristic of this stage, one finds usually that some of the glands are still very hypertrophic, while

¹ Read at the meeting of the Johns Hopkins Hospital Medical Society, May 17, 1915.

others already show the collapse characteristic of the post-menstrual stage. A similar transition is noted in the stromal tissue

In the six years which have elapsed since the publication of the work of Hitschmann and Adler many articles have appeared in confirmation of their results, and a few in which a greater or less degree of contradiction is expressed. Among the more important of the latter may be mentioned those of Henkel (2), and Keller and Schickele (3). Both of these, however, have been very adequately answered in the recent exhaustive review of the subject by Hitschmann and Adler (4). At any rate, the weight of evidence at the present day is overwhelmingly in favor of the general correctness of their teaching, although on certain details there is still room for discussion.

The study of any considerable number of endometria from this viewpoint must impress one with the striking differences in the degree of hypertrophic change brought about by the menstrual influence. All gradations are to be seen in the microscopic appearance in the so called premenstrual period, from moderate glandular hypertrophy to the exaggerated glandular and stromal overgrowth which even suggests the appearance of decidua. In view of these wide variations in the degree of local hypertrophy the question suggests itself as to whether these variations are in any way related to the well known differences existing in different women with regard to the clinical character of menstruation. Aside from actual abnormalities of menstruation, there are women in whom the normal duration of the flow is perhaps only a day or two the amount being very scanty. Other women, also entirely normal, may habitually menstruate 6 or 7 days the flow being profuse. Other things being equal does the endometrium in the latter type of woman exhibit a greater degree of menstrual hypertrophic change than the endometrium from the woman who menstruates very scantily? The incentive for the present study was derived principally from a consideration of the subject of these two queries.

Such a study as this must of necessity be

one of comparison, and a proper basis for such comparison is the first desideratum. It would be of little value, for example, to compare the uterine mucosa obtained on the seventh or eighth day before menstruation with one which was removed only a day or two before the onset of the period. The time element in comparison can, however, be definitely fixed by comparing only endometria removed on the same day of the menstrual cycle. The importance of accurate menstrual histories in the cases to be studied is obvious. So long as the periodicity of menstruation is undisturbed, it would seem to be wise to include in such a study, not only normal cases, but also those illustrating various forms of pelvic disease which might be capable of influencing the clinical intensity of menstruation, i. e. the duration and amount of the flow.

BASIS OF PRESENT STUDY

The cases upon which this study is based were selected from the records of nearly two thousand clinical cases admitted to Dr. Kelly's service between October 1911, and October, 1913 (with the exception of a few earlier cases). From these were selected all those cases in which the endometrium had been removed, either by curettage or by hysterectomy. There were 339 cases of this kind. A considerable number of these were not suited for the purposes of this study on account of the insufficient amount of the scrapings. Others again were eliminated because of the fact that the histories were not as explicit as might have been wished from the standpoint of this study. This, of course, applies especially to the menstrual histories for no case was admitted to the series unless it carried with it full data from this viewpoint — the age at which menstruation began, its regularity or irregularity, the intervals at which it recurred, the duration of the flow, its amount or severity, the occurrence or non occurrence of pain, the presence or absence of clots, and last but not least, the dates of occurrence of the last two menstrual periods. Among other elements of the histories, especial consideration was given to the age of the patient, the date and

character of the operation, the pathological condition or conditions from which the patient suffered, her social condition (married or single), the number of childbirths, etc. By such a process of elimination as that indicated above, the number of cases in which the microscopic sections and the histories were found satisfactory was reduced to 268. The entire number of cases was now easily divisible into two main groups: viz., (1) those in which menstruation, whatever its other clinical variations may have been, still retained its regular periodicity, the interval of recurrence in the great majority of cases being, of course, 4 weeks, (2) those in which the menstrual rhythm had been broken, the periods recurring at irregular intervals. Cases of the latter group would be obviously unsuitable for an investigation in which the chronology of the menstrual cycle plays such an essential part, so that I have based this study upon the first of these groups, representing a total of 159 cases. The other group—the cases of atypical menstruation—numbering 109, I hope to make the basis of a later study.

As will be seen, the series of cases analyzed in this paper includes many types of pelvic lesion, in addition to a certain number in which the pelvic organs were described as normal. In all the cases, however, the menstrual cycle was undisturbed. In this connection Hitschmann and Adler, as well as Schroder (5) and others, have shown that even local disease in the endometrium as a rule has no disturbing effect upon the menstrual cycle. In the great majority of my cases, however, the endometrium is quite free from any pathological alteration.

A moment's consideration will show that such a study as the one here attempted must of necessity be strongly tintured with the personal element, and that it cannot be a mathematically exact one. For example, however intelligent a patient may be, and however conscientious the writer of the history, it is in many instances quite impossible for the former to recall or the latter to extract the exact date of a menstrual period which occurred two or three weeks previously. Fortunately, however, such an investigation

as the present one is not vitiated by slight deviations in this respect, for we are concerned with the stages rather than with the specific days of the menstrual cycle. In describing the amount of the menstrual flow, it is even more difficult to fix a standard of comparison, but the three adjectives which I have used to designate varying amounts of the menstrual flow—"scanty," "moderate," and "profuse"—would appear to be sufficiently accurate for ordinary purposes when their use is based upon a consideration of the patient's entire history. The personal equation, again, enters into the appraisal of the microscopic findings, although this element is minimized when all the examinations are made by the same person. Even so, however, errors of judgment may arise from the fact that the menstrual hypertrophic change does not involve all parts of the uterus uniformly, but passes over the endometrium in a wave-like manner (Hitschmann and Adler). For this reason the hypertrophic changes may be considerably more advanced in one portion of the uterus than in another. The endometrium of the lower portion of the uterine cavity and that in the cornua is said to present less advanced changes as a rule than in the remainder of the uterus, for the reason that the pressure of the opposing uterine surfaces in these regions prevents full development of the glands. Again, curettings from the superficial compact layer of the endometrium are apt to give one the impression of a lower grade of gland hypertrophy than those from the deeper or spongy layer. In the preparation of curettings, bits of tissue from different portions of the uterus are sometimes brought side by side in the microscopic section, thus frequently giving rise to rather confusing pictures.

A condensed summary is given below of the series of 159 cases, divided into groups according to the day of the menstrual cycle on which the endometrium was removed. In designating the day of the menstrual cycle on which the endometrium has been removed, reference is made to the number of days which have elapsed since the first day of the last menstruation. The first day of menstruation is the one fixed date in the cycle of

normal, regular menstruation, and hence is the logical point of departure in a chronological study of the histology of the process. A statement is given of the microscopic findings in each group of cases—collectively where possible, individually where noteworthy differences exist between cases in the same chronological group. The terms applied by Hirschmann and Adler to the microscopic pictures at different periods of the menstrual cycle—post-menstrual, interval, premenstrual—have come to have a definite meaning to gynecological pathologists, and, for brevity's sake, I have used them wherever possible. By far the large majority of the cases are characterized by the four-week type of menstruation, but a small number (13) were marked by menstruation of other types, and these are included in a separate table.

It will be noted that throughout this paper much more stress is laid upon the glandular changes than upon those occurring in the stroma. The latter are not nearly so striking or so constant as the former, which would therefore seem to constitute the more logical and more convenient criterion of the degree of hypertrophic change in the endometrium. In only a comparatively small proportion of the cases is there such a striking overgrowth of the stromal cells that they are at all likely to be mistaken for genuine decidua cells. On the other hand, a greater or less degree of gland hypertrophy, easily appreciable on microscopic examination, is quite constant. It must not be assumed that the glandular phenomena are primary in character. Like other mucous glands, the utricular glands are merely reduplications of the mucous membrane, the evident purpose of which is to increase the secreting surface. When the glands show dilatation of the lumina and exaggerated infoldings as they do in connection with the premenstrual hypertrophy, it is because the individual cells are swollen and overgrown. Room is made for these enlarging cells by increasing convolution of the glands. The full significance of the gland changes, however, will be discussed later in the paper.

It may be noted that there are few cases of cancer included in the series which I have

studied. This is explained by the fact that in such diseases as cancer, menstruation is so frequently atypical, intermenstrual bleeding being observed sooner or later, and these cases have therefore been excluded from this series. It may be stated, however, that even in such pathological conditions as carcinoma of the cervix the menstrual cycle in the endometrium is usually unaffected, intermenstrual bleeding in such cases being evidently due to the destructive tissue changes characteristic of diseases of this type.

CASES OF THE FOUR-WEEK TYPE

First day. One case clinically diagnosed as salpingitis. Menstruation had commenced just a few hours before the operation (hysterectomy). Some of the glands are enormously hypertrophic, others are narrower. The stromal cells in many places show various grades of transition toward the decidual type.

Third day. One case, clinically diagnosed as stenosis of the internal os with dysmenorrhœa. Endometrium shows a characteristically post-menstrual appearance, although relics of the premenstrual hypertrophy are seen as crumpled-looking gland lumina.

Fourth day. Five cases, including one of simple antelexion, one of squamous-cell carcinoma of the cervix, one of pelvic inflammatory disease, one of uncomplicated myoma, and one of myoma complicated by adnexal inflammation. Endometrium typically post-menstrual in all cases.

Fifth day. Seven cases. Of these four were clinically diagnosed as pelvic inflammatory disease, one as myoma complicated by adnexal inflammation, one as intraligamentary ovarian cyst, and one as infantile uterus associated with dysmenorrhœa. Endometrium post menstrual in all (see Fig. 1).

Sixth day. Nine cases including five with pelvic inflammatory disease, one with laceration of the cervix and perineum, one with myoma complicated by adnexal inflammation, one with antelexion, and one with menorrhagia not associated with demonstrable pelvic disease. In all these cases the endometrium presented the appearance characteristic of the post-menstrual or early interval period.

Seventh day. Eight cases. Of these the clinical diagnosis in four is pelvic inflammatory disease, in one multiple myoma, with adnexal disease, in one relaxed vaginal outlet, in one adenomyoma of the uterus, and in one retroposition of the uterus with congenital atresia of the vagina. Endometrium of early interval type.

Eighth day. Fifteen cases, including five of antelexion four of myoma with pelvic inflammatory disease, one of uncomplicated myoma, one of primary carcinoma of the left tube, four of pelvic inflammatory disease (in three of which there was also relaxation of the vaginal outlet). In some of these cases the glandular development was somewhat more advanced than in others but the differences were slight, and all the specimens are classifiable as late post-menstrual or early interval.

Ninth day. Four cases, including one of antelexion one of myoma with adnexal inflammation, and two of pelvic inflammatory disease. In all these cases the endometrium was of the late post menstrual or early interval type.

Tenth day. Four cases, including two cases of myoma with adnexal disease and two of pelvic inflammatory disease. In three of these cases the endometrium was of the characteristic interval appearance. In one of the four cases (Gyn Path No 16,889), diagnosed clinically as chronic pelvic inflammatory disease the glands are very narrow and straight, i.e., post menstrual in type. The stroma shows the presence of many spindle cells, the interstitial tissue in places apparently encroaching upon the gland lumina. Numerous clumps of small blood vessels are seen in the endometrium. Henkel lays much emphasis upon this as an evidence of chronic endometritis, although its importance is denied by Hirschmann and Adler. At any rate this section is evidently one of chronic endometritis. It may be of further significance to add that although the hysterectomy in this case was performed on the tenth day of the menstrual cycle, it was done immediately after the cessation of a menstrual period, for the duration of menstruation in this case was 8 to 10 days.

Eleventh day. Three cases. Of these one was a case of hemorrhage of puberty (no demonstrable pelvic disease), one of lacerated cervix and perineum and retroposition of the uterus, and one of myoma with pelvic inflammatory disease. In the last-named case the endometrium is of the post menstrual type, the straight narrow glands being beautifully shown in longitudinal section (Gyn Path No 18,883). In the other two cases the endometrium is of the interval type.

Twelfth day. Four cases, including two of antelexion with dysmenorrhœa, one of large myoma with tubal inflammation, and one of mild subacute pelvic inflammatory disease. The endometrium from all these cases is of the interval type, but, contrary to what one might expect, the glandular development is considerably more advanced in the two cases of antelexion (Gyn. Path Nos 18,518 and 16,670) than in the other two. This is especially true of Gyn Path No 18,518. Clinically, menstruation in this patient was described as profuse, painful, and lasting five days.

Thirteenth day. Five cases, including one of uncomplicated myoma, one of myoma complicated by tuberculous peritonitis and tuberculous endometritis, one of double pyosalpinx, one of lacerated cervix and perineum, and one of retroposition of the uterus. In spite of the wide diversity in the pathological lesions present in these five cases, there is really no very striking difference in the picture presented by the endometrium, so far as the degree of glandular development is concerned. This applies even to the case in which there is local disease in the endometrium, that of tuberculous endometritis (Gyn. Path No 18,618). Leaving out of consideration the characteristic local manifestation of the tuberculous process, the glands in this case, as in the others of this group, are of the interval type.

Fourteenth day. Six cases, including two of antelexion with dysmenorrhœa (the uterus being infantile in one of these), one of double hydrosalpinx, one of double tubo-ovarian abscess, one of multiple myomata, and one of infected ovarian cyst. While in all these cases the endometrium is of the interval

type, there are differences in degree of gland development. Especially noteworthy, perhaps, is the fact that, as in one of the groups already discussed, the glands are most developed in the two cases of antelexion. Especially striking are the hypertrophic changes in Gyn Path No 883 in which the hypertrophy and convolution of the glands are comparable to those seen in many cases during the "premenstrual" stage. The epithelium shows no mucoid change, and the stroma shows nothing of note except a moderate oedema in places. Menstruation in this patient was of five days' duration, free and intensely painful. This group incidentally furnished a good illustration of the fact that even in the presence of undoubted pelvic infection the endometrium is apt to be found quite normal. This is well exemplified by Gyn Path No 19400 in which a double tubo-ovarian abscess is associated with a perfectly normal uterine mucosa.

Fifteenth day. Twelve cases. In this group are four cases of antelexion with dysmenorrhœa, one of lacerated cervix and perineum, one of cervical polyp, lacerated cervix and perineum and retroposition of the uterus, two of pelvic inflammatory disease (one acute, one chronic), one of myoma with relaxed vaginal outlet, one of myoma with bilateral lutein cysts of the ovaries, and two of myoma with cervical polypi. The most conspicuous fact in connection with this group is that here again it is the cases of antelexion which exhibit the greatest degree of hypertrophic change. In two of them (Gyn Path Nos 16633 and 19001) the glandular hypertrophy is quite as pronounced as that characteristic of the premenstrual stage (see Fig 3). The ages of the four antelexion patients are 20, 21, 23 and 23. Two are single and two are married, but none of them has borne children. The significance of these facts will be emphasized later. Taken as a subgroup the myoma cases, strange as it may seem, show much less hypertrophic change in the mucosa than do the antelexion cases. As possibly bearing on this fact I may say that in only one of the myoma cases is menstruation described as

profuse, being spoken of as "moderate" in all the others, while, furthermore, all four cases of this subgroup are at or near the age of the menopause, although menstruation was still regular in all. The ages were, respectively, 39, 42, 47, and 55.

Sixteenth day: Five cases, including one of chronic appendicitis with dysmenorrhœa (pelvic organs normal), two of myoma with chronic appendicitis, one of relaxed vaginal outlet and retroposition of the uterus, and one of tuberculous salpingitis. The least developed glands are seen in Gyn Path No 19623, a case of myoma in which menstruation was described as "moderate" and lasting three days. The greatest hypertrophy, on the other hand, is seen in the other myoma case (Gyn Path No 18837), in which menstruation lasted 5 to 7 days, and is described as profuse. The case of tuberculosis of the tubes (Gyn Path No 18559) shows no involvement of the endometrium. It illustrates very well the different appearances presented by different portions of the same specimens. In some places the glands show marked hyperplasia, so that the lumina are crowded closely together, with very little stroma between them. In other parts, on the other hand, there is only slight glandular increase, with moderate tortuosity.

Seventeenth day. Seven cases including one of antelexion, two of relaxed vaginal outlet, one of retroposition with relaxed outlet, one of cystic ovary, one of subacute pelvic inflammatory disease, and one of myoma complicated by pelvic inflammatory disease. No noteworthy differences as to glandular development are observed in this group, although perhaps the most decided hypertrophy is noted in the myoma case (Gyn Path No 19572). Clinically this case was characterized by profuse menstruation, the duration of which was 8 days.

Eighteenth day. Six cases, three being diagnosed clinically as antelexion with dysmenorrhœa, and three as chronic pelvic inflammatory disease. This division into two groups affords an excellent opportunity for comparison. There is no question that glandular hypertrophy is much more marked in the antelexion group than in the three

cases in which there was inflammatory disease (double salpingitis in two, light adhesions in one). As a matter of fact, the case in which the glandular change is most marked is one of antelexion in which the uterus is of the infantile type (Gyn Path No 13,140). The microscopic picture in this case is typically premenstrual (see Fig 4). The age of this patient was 18, that of the other antelexion patients respectively 18 and 22. Two were married and one single, but none had ever been pregnant. I emphasize this subgroup because it again illustrates the rather surprising frequency with which the endometrium in cases of simple antelexion exhibits hypertrophic changes of much greater degree than those observed in association with even the most extensive pelvic lesions (see Fig 5).

Nineteenth day: Four cases, including two of retroposition of the uterus (in both of these there was also relaxation of the vaginal outlet), one of antelexion, and one of moderate prolapse of the uterus with chronic pelvic inflammatory disease. It is interesting to note that the three cases in which the history shows menstruation to have been profuse are characterized microscopically by decidedly more glandular change than the other two, in both of which menstruation was scanty.

Twentieth day: Four cases, including two of chronic pelvic inflammatory disease, one of uncomplicated myoma, and one of tuberculous peritonitis (no involvement of endometrium). In all these the endometrium is of the late interval type, showing considerable gland hypertrophy.

Twenty first day: Six cases, including one of relaxed vaginal outlet, one of chronic endocervicitis, one of moderate prolapse of the uterus with relaxed outlet, one of myoma with double pyosalpinx, one of right pyosalpinx and one of left hydrosalpinx. Of these the greatest interest attaches to the case of right pyosalpinx (Gyn Path No 18,661). The clinical history of this patient speaks of menstruation as "profuse," the flow lasting 3 days. Microscopic examination of the mucosa after hysterectomy shows that the glands are very narrow, slightly convoluted. It appears that the lumina are being gradually

obliterated by the preponderating interstitial tissue, which contains large numbers of round and spindle cells. In other words, we have to deal with a pronounced form of chronic interstitial endometritis, so marked as to suggest the appearance of a senile endometrium. The patient, I may add, was only 30 years old, and menstruation had been quite regular since the age of 13. The low grade of the gland changes in this case under the influence of the approaching menstrual period is perhaps explainable by the obvious subordination of the glands to the stroma in such an endometrium.

Twenty-second day: Fourteen cases. Five of these were diagnosed as antelexion, four as chronic pelvic inflammatory disease, two as myoma with adnexal inflammation, one retroposition with lacerated cervix and perineum, one as tuberculous endometritis and salpingitis and one as diffuse fibrosis uteri with polypoid endometritis. By far the most advanced gland hypertrophy is noted in Gyn Path No 18,936, the case of retroposition of the uterus with lacerated cervix and perineum. There is a typical premenstrual hypertrophy of the glands, the epithelium showing mucoid change. This patient was a woman of 34, in whom menstruation had been for 8 years more and more profuse, sometimes lasting as long as 8 days. As a class the five cases of antelexion showed glandular hypertrophy to considerably greater degree than the average found on this day of the menstrual cycle. This is especially true of Gyn Path No 11,126, in which the microscopic appearance of the mucosa is typically premenstrual. Incidentally, this is the first section in this series which clearly illustrates the decidua-like transformation (*deciduaähnlichkeit*) of the stromal cells.

Twenty third day: Two cases; one of simple retroposition of the uterus, and one of double pyosalpinx with an abscess of the uterine wall. The latter shows an endometrium which would be classed as of the late interval type while the endometrium from the retroposition case on the other hand, is typically and markedly premenstrual, showing much gland hypertrophy and also the characteristic decidua transformation of the stroma.

cells. In both menstruation was described as profuse.

Twenty-fourth day. Three cases, including two of antelexion with dysmenorrhœa and one of simple retroposition of the uterus. The two patients with antelexion were unmarried, the other patient was married, but all were nulliparous. In none was there any other pelvic abnormality, and all of them suffered with dysmenorrhœa. They therefore present many points in common. In all of them microscopic examination shows considerable gland hypertrophy, most marked in Gyn Path No 4250, a case of antelexion.

Twenty-fifth day. Two cases, one of myoma complicated by adnexal inflammation and one of relaxed vaginal outlet with chronic appendicitis. While considerable hypertrophic change is evident on microscopic examination, it is not extreme. In the myoma case (Gyn Path No 19,406), in which menstruation was profuse, the glandular changes are more marked in the other (Gyn Path No 17,020), in which menstruation is described as "moderate" in amount.

Twenty-sixth day. Two cases, one of complicated myoma and one of simple retroposition with chronic appendicitis. The myoma case (Gyn Path No 18,500) shows moderate tortuosity of the glands, although the lumina as a rule are rather narrow. The stroma is compact and contains many spindle cells. In spite of the myoma in this case menstruation was moderate in amount, and lasted 3 or 4 days. On the other hand, the other case in this group (Gyn Path No 19,521) yields an endometrium which is typically premenstrual. The glands are hypertrophic and convoluted, the epithelium is mucoid, the stroma cells are in places distinctly overgrown, and the stroma as a whole is oedematous. The subepithelial hæmatoma on which Gebhard laid so much stress are well shown in this section. In view of these facts it is interesting to add that menstruation in this case was described as "excessive," its duration being 1 week.

Twenty-seventh day. Two cases, both of antelexion with dysmenorrhœa and both illustrating beautifully in the microscopic pictures the exaggerated hypertrophic changes

of the premenstrual period. In one of them (Gyn Path No 19,361) menstruation was excessive, and the hypertrophic changes in this case are perhaps somewhat more marked than those in the other (Gyn Path No 11,680), in which menstruation was moderate in amount (see Fig 2).

Twenty-eighth day. Five cases. Among these were two cases of antelexion with dysmenorrhœa, one case of chronic pelvic inflammatory disease, one of simple myoma, and one of complicated myoma. The endometrium in all the cases of this group, in which operation was done just before the expected onset of menstruation, exhibits striking hypertrophic changes. Both the cases of antelexion show much gland hypertrophy, especially Gyn Path No 17,024, which presents a full blown premenstrual picture, in the sense of Hitschmann and Adler. In both of the myoma cases (Gyn Path Nos 19,526 and 16,815) there is hypertrophy of the glands, but in neither is it excessive. In the former, menstruation was rather scanty; in the latter, profuse. Finally the case of pelvic inflammatory disease is characterized by well defined hypertrophic changes.

CASES OF THE THREE-WEEK TYPE

Fourth day. Two cases, both of menorrhagia without demonstrable pelvic disease. In neither case was there any glandular hypertrophy.

Tenth day. One case of simple myoma, age 38, in which the endometrium was of the interval type. Menstruation in this case was described as scanty, the periods lasting 2 days.

Eleventh day. One case, also of myoma, in which there is some glandular hyperplasia, although the glands are as a rule quite narrow. The patient was 33 years old, and menstruation was profuse.

Fourteenth day. One case of menorrhagia of unknown origin in a patient of 30. For 8 months the patient had been menstruating every 3 weeks although the amount is described as moderate. The endometrium is of the interval type.

Fifteenth day. Two cases. Of these one (Gyn Path No 19,594) was a case of retro-

position with chronic endocervicitis (age 34), with excessive menstruation, the flow sometimes lasting 2 weeks. Considerable gland hypertrophy was noted in the endometrium. The other (Gyn Path No 19,113) was a woman of 47 with climacteric bleeding. For 3 years she had menstruated every 3 weeks, the flow being profuse and lasting 7 days. Marked glandular hyperplasia and tortuosity are seen in the endometrium.

Sixteenth day One case of simple myoma in a woman of 38. The menstrual flow was profuse, lasting 5 days. Marked glandular hypertrophy is shown by the endometrium.

Twentieth day Two cases, including one of chronic pelvic inflammatory disease, and one of reposition with cystic left ovary. In both of these cases menstruation was profuse and in both of them the endometrium shows striking hypertrophic changes. This is especially so of the case of reposition (Gyn. Path No 19,425), in which a beautiful picture of the premenstrual type of endometrium is seen (Fig 6).

CASES OF OTHER TYPES

Second week type Only two cases were encountered in which menstruation occurred regularly every 14 days. In both of these cases operation was done on the eighth day of the cycle. One was a case of relaxation of the vaginal outlet, the other of chronic inflammatory disease. In both menstruation was described as profuse, and there is gland hypertrophy, especially in the case of perineal relaxation (Gyn Path No 16,720).

Five week type One case was encountered in which the patient asserted that menstruation occurred regularly every 5 weeks. It was a case of reposition and relaxed outlet in a patient of 26, in whom operation was done on the fourteenth day of the cycle. The endometrium was of the interval type.

Three and one half week type In one case of myoma, complicated by left tubo-ovarian abscess, the patient stated that she had always menstruated at intervals of three and one-half weeks, the flow being described as "not profuse." Hysterectomy was done on the fifteenth day of the cycle. The glands seen in the endometrium are of the interval type.

WHAT THE STUDY INDICATES

A consideration of the results recorded in this synopsis will indicate, first of all that another confirmation is added to the many which have been published in support of the general principle enunciated by Hitschmann and Adler, i.e., that from the end of one menstrual period to the beginning of the next the endometrium is undergoing a process of gradual development which reaches its climax just before menstruation begins. One or two details of this investigation, however, will bear discussion. While Hitschmann and Adler state that the premenstrual change is in the nature of a rather sudden flare up beginning from a few days to a week or more before the beginning of the next menstrual period, it has seemed to me that the developmental process is a very gradual one from one menstrual period to another, and that there is no sharp dividing line between the interval and the premenstrual stages, any more than there is any sharp transition between the post-menstrual and the interval phases. Whatever the stimulus to which the endometrial changes are due, its action seems to be a cumulative one, so to speak, reaching its acme just before menstruation. The latter is now generally looked upon as a destructive process, during which the endometrium drops from the highest to the lowest point of its development.

There are wide individual differences in the degree of premenstrual hypertrophy. The classical type described by Hitschmann and Adler is seen in only a part of the cases — just what the percentage is I am not prepared to state. Hypertrophy of the glands appears to be an invariable occurrence, but it differs much in degree. The same applies to the degree of mucoid change in the epithelium, which in some cases is very slight, in others extremely marked.

The stromal changes, as I have already remarked, are much less constant and, as a rule much less striking than those in the glands. (Edema, contrary to the former opinion, appears to be without significance, for it occurs almost as frequently in the post-menstrual or interval periods as in the premenstrual. Its occurrence, like that of

blood, has been explained (Schroder) as due to traction on the uterus during the operation of curettage, and to other traumatism during this or other operative procedures. This, however, is only a hypothesis, and is not borne out by clinical experience. In many instances there is little or no appreciable hypertrophy of the stromal cells during the premenstruum. In a certain proportion of cases the transformation of the cells is very striking, so that they strongly suggest true decidua cells, but as a rule there is only a moderate degree of hypertrophy, the cells being of transitional type. The fully developed premenstrual picture of the classical type is very characteristic — much more so than that associated with any other period of the menstrual cycle. For example, I have never observed the premenstrual appearance, in the sense of Hitschmann and Adler, in any endometrium removed just after a menstrual period. On the other hand, I have frequently observed, during the period which chronologically corresponds to the premenstruum, only a very moderate degree of hypertrophy of the glands and perhaps no appreciable change in the stroma.

These last statements confront us again with the query which we set for ourselves as the main consideration of this paper: Do the wide histological differences in the endometrium at different stages of the menstrual cycle correspond in any way to the equally wide differences which exist among women with regard to the amount and duration of the menstrual period? A careful analysis of the cases in this series leads me to believe that speaking generally the greater the clinical intensity of menstruation the greater the local reaction in the endometrium, as manifested by hypertrophic changes in the glands and to a less extent in the stroma. This statement is seen to apply as regards menstruation in association with all the various forms of pelvic disease above enumerated, *with the exception of one important group*. It may be noted in the above synopsis that when the various groups are studied from day to day of the menstrual cycle it is in those spoken of as antelexion that the earliest awakening of the glands is observed, and that

the premenstrual hypertrophy is apt to reach fullest development. This is rather remarkable in view of the fact that in many of these cases of antelexion in young women, associated with dysmenorrhœa and usually sterility — and all the cases are of this type — menstruation as a rule is scanty rather than profuse. To determine definitely that this group of cases really does constitute an exception to the general rule which seems to apply to the others, it seemed wise first of all, to compare all the cases showing definite hypertrophic changes in the glands, irrespective of the Hitschmann and Adler plan of division into stages. Special note is made of those exhibiting very marked hypertrophic changes, corresponding, for example, to the outspoken premenstrual picture. The picture in such cases may be spoken of as + hypertrophy. A third table presents the findings in the 33 cases of antelexion alone.

THE "MENSTRUAL REACTION" IN CASES OF CONGENITAL ANTELEXION

A study of these tables shows how uniform it is to find hypertrophic changes beginning at an unusually early period in the menstrual cycle in cases of antelexion, and how common it is to find that in this group of cases the hypertrophy is as a rule more marked than in other forms of gynecological disease operated upon at the corresponding stage of the cycle. Even if it were true that glandular increase may be due to inflammation it would scarcely be conceivable that the antelexion cases, above all others should show such an inflammatory involvement of the endometrium. Moreover the endometrium from cases of antelexion in which operation was done early in the menstrual cycle shows the same picture — post-menstrual or interval — as does the endometrium removed at the corresponding period in cases in which various pelvic lesions are present (Fig. 1). The subsequent appearance of gland hypertrophy, therefore must be looked upon as a cyclical developmental phenomenon and as being purely physiological in nature.

A better idea of the significance of these findings will perhaps be given by a consideration of the results from a percentage view-

TABLE I—CASES SHOWING HYPERTROPHY OF GLANDS

Gyn. Path No	Age	Diagnosis	Day of Menstrual Cycle	Menstruation	Pregnancy
18 512	28	Anteflexion	12th	Profuse 5 days	0
883	32	Anteflexion	14th	Free 5 days	0
19 001	20	Anteflexion	15th	Profuse 6 to 7 days	0
19 372	23	Anteflexion	15th	Scanty 7 days	0
16 633	23	Anteflexion	15th	Scanty 7 to 8 days	0
18 837	41	Myoma (complicated)	16th	Profuse 5 to 7 days	2
18 550	27	Tuberculous peritonitis	16th	Moderate 6 days	0
19 572	32	Myoma (complicated)	17th	Profuse 8 days	0
16 038	41	Pelvic inflammation	18th	Moderate 3 to 5 days	6
28 675	22	Anteflexion	18th	Moderate 3 days	0
13 740	18	Anteflexion (infantile uterus)	19th	Profuse 5 to 6 days	0
16 725	15	Pelvic inflammation	19th	Profuse 5 days	1
16 028	22	Retroposition and relaxed outlet	19th	Profuse 8 days	1
19 097	33	Pelvic inflammation	20th	Free 5 days	0
19 450	38	Myoma (complicated)	21st	Profuse 5 to 6 days	0
17 073	23	Hydrosalpinx	21st	Rather free 4 days	2
19 132	41	Relaxed outlet	21st	Moderate 5 days	1
16 684	34	H3 hydrosalpinx	22d	Profuse 4 days	4
18 517	32	Anteflexion	22d	Profuse 10 days	0
16 838	30	Fibrosis uteri and polypoid endometritis	22d	Moderate 4 to 5 days	2
16 884	30	Normal generative organs	22d	Profuse 5 days	0
11 388	19	Anteflexion	22d	Moderate 4 to 5 days	0
19 371	33	Anteflexion	22d	Profuse 4 days	1
18 523	26	Pyosalpinx and abscess uterus	23d	Profuse 4 to 5 days	2
16 612	23	Retroposition	24th	Moderate 4 days	0
19 139	27	Anteflexion	24th	Scanty 5 days	0
19 406	42	Myoma	25th	Profuse 8 to 11 days	0
17 020	24	Relaxed outlet	25th	Moderate 4 to 5 days	2
18 500	30	Myoma (complicated)	26th	Moderate 3 to 5 days	1
19 5 6	26	Myoma	28th	Scanty 3 days	0
16 815	41	Myoma (complicated)	28th	Profuse 7 days	1
27 017	42	Pelvic inflammation	28th	Profuse 7 days	7

point For example of the 113 cases of pelvic disease of one form or another other than congenital anteflexion 26 (23 per cent) showed hypertrophy of the endometrium including 5 (4½ per cent) with + hypertrophy In the 26 cases with hypertrophy menstruation was profuse in 18 (69 per cent), moderate in 7 (27 per cent), scanty in 1 (4 per cent) In the 5 cases of + hypertrophy menstruation was profuse in all (100 per cent)

On the other hand of the 33 cases of ante-

flexion 18 (55 per cent) exhibited hypertrophy of the endometrium, including 7 (21 per cent) with + hypertrophy In the 18 cases of hypertrophy, menstruation was profuse in 7 (39 per cent), moderate in 7 (39 per cent) scanty in 4 (22 per cent) In the 7 cases of + hypertrophy menstruation was profuse in 1 (14 per cent) moderate in 5 (72 per cent), and scanty in 1 (14 per cent)

The two facts which seem to be brought out by this work are that (1), speaking gener-

TABLE II.—CASES SHOWING + HYPERTROPHY OF GLANDS

Gyn. Path No.	Age	Diagnosis	Day of Menstrual Cycle	Menstruation	Pregnancy
10 376	35	Double tubo-ovarian abscess	1st	Profuse 5 to 9 days	2
18 936	34	Retroposition lacerated cervix and perineum	22d	Profuse 6 to 8 days	3
11 126	26	Anteflexion	22d	Moderate 4 to 5 days	0
16 630	31	Anteflexion	23d	Scanty 1 to 3 days	1
10 275	20	Retroposition	23d	Profuse 4 to 7 days	0
4 250	22	Anteflexion	24th	Moderate 5 days	0
10 521	38	Retroposition	26th	Profuse 7 days	1
11 680	20	Anteflexion	27th	Moderate 4 to 5 days	0
10 161	33	Anteflexion	27th	Profuse 7 days	0
10 551	21	Bilateral tubo-ovarian abscess	28th	Profuse 4 to 5 days	0
17 021	30	Anteflexion	28th	Moderate 5 days	0
17 021	31	Anteflexion	28th	Moderate 3 to 4 days	0

ally, the greater the clinical duration and amount of the menstrual flow the greater the degree of local hypertrophic reaction in the endometrium, and (2) that an exception to this general law is apparently encountered in cases of anteflexion of what is commonly called the congenital type, i.e., the type so frequently observed in young women and associated with dysmenorrhœa, rather scanty menstruation, and not infrequently sterility. These two statements deserve a further word of discussion, if only for the purpose of qualifying them so as to make them seem less dogmatic.

The degree of menstrual hypertrophy with various pelvic diseases. Even in the presence of such conditions as adnexal infection and inflammation it is now generally recognized that the endometrium is in the great majority of cases quite normal. As far back as 1898 Cullen (6) reported a study of 1800 cases from the Johns Hopkins Hospital, only 49 cases of endometritis being found in this series. He emphasized the comparative rarity of this condition, even in association with well marked pelvic inflammation. As far as mere glandular increase is concerned, Hitschmann and Adler make the statement that in many thousands of observations they do not recall a single case in which a new formation of glands was attributable to inflammation. As a matter of fact, it is difficult to comprehend how such a patho-

logical increase could be recognized in view of the marked individual variations in different cases, and more especially in view of the constantly changing microscopic picture presented by the endometrium in the different stages of the menstrual cycle. Buttner (7) and Schroder (5) have also made interesting studies, as a result of which they reach the same conclusion as Hitschmann and Adler. The latter, it must be added, do not maintain that all the alterations of the endometrium are purely physiological, and that there is no such thing as endometritis. On the contrary, they emphasize the importance of endometritis of the interstitial type and admit the occurrence of pathological hyperplasia of the endometrium. The latter, as a distinct pathological entity, was first described by Cullen (8). It may occur at any age, but is most common between the ages of 40 and 50. It is invariably associated with profuse menstruation and at times with intermenstrual bleeding. The histological appearance is very characteristic. The mucous membrane is much thickened. Some of the glands are large and many of them dilated. This dilatation is not according to Cullen, due to occlusion and cyst formation, as the gland epithelium is proliferated and high rather than low and flattened as it would be in a retention cyst. Many of the enlarged glands are irregular in outline. The stroma is rich in cell elements and nuclear figures

TABLE III — CASES OF ANTEFLEXION

Gyn. Path. No.	Age	Social Condition	Pregnancy	Day of Cycle	Menstruation	Endometrium
10 373	27	Married 4 years	0	1d	Moderate 2 days pain	Postmenstrual
10 068	23	Unmarried	0	4th	Variable 3 to 5 days pain	Postmenstrual
4 106	23	Married 3 years	0	5th	Not profuse 3 to 4 days pain	Postmenstrual
16 693	20	Married 12 years	0	6th	Moderate 4 to 5 days no pain	Postmenstrual
13 378	20	Married 2 years	0	8th	Moderate 3 to 4 days pain	Interval
10 324	22	Unmarried	0	8th	Scanty 4 days pain	Interval
10 052	25	Married 2 years	0	8th	Moderate 4 days pain	Postmenstrual
9 027	20	Unmarried	0	8th	Free 4 to 6 days pain	Postmenstrual
18 677	24	Unmarried	0	8th	Moderate 4 days pain	Early interval
18 518	28	Married 3 years	0	11th	Profuse 5 days pain	Hypertrophy
16 770	17	Unmarried	0	12th	Moderate 3 days pain	Interval
883	32	Widow	0	14th	Free 5 days pain	Hypertrophy
12 044	21	Married 2 years	0	15th	Profuse 2 to 4 days pain	Interval
10 001	20	Unmarried	0	15th	Profuse 6 to 7 days slight pain	Hypertrophy
10 372	21	Married 6 years	0	15th	Scanty 7 days no pain	Hypertrophy
16 633	23	Unmarried	0	15th	Scanty 2 to 3 days pain	Hypertrophy
4 156	20	Unmarried	0	17th	Scanty 4 to 5 days + pain	Interval
10 325	24	Married 2 years	0	17th	Moderate 5 days slight pain	Interval
18 673	22	Married 1½ years	0	18th	Moderate 3 days pain	Hypertrophy
13 140	18	Married 2 years	0	19th	Rather profuse 5 to 6 days pain	Hypertrophy
10 506	22	Married 6 months	0	19th	Scanty 3 days + pain	Interval
18 517	32	Married 11 years	0	22d	Profuse 10 days pain	Hypertrophy
11 126	20	Married 7 years	0	22d	Moderate 4 to 5 days no pain	+ Hypertrophy
11 385	20	Married 1½ years	0	22d	Moderate 4 to 5 days + pain	Hypertrophy
10 371	31	Married 15 years	1	22d	Profuse 4 days slight pain	Hypertrophy
16 020	23	Married 5 years	0	22d	Scanty 2 to 4 days + pain	Interval
16 630	31	Married 8 years	1	22d	Scanty 2 to 3 days pain	+ Hypertrophy
4 150	22	Unmarried	0	24th	Moderate 5 days pain	+ Hypertrophy
10 130	27	Unmarried	0	24th	Scanty 5 days + pain	Hypertrophy
11 690	20	Unmarried	0	24th	Moderate 4 to 5 days + pain	+ Hypertrophy
10 361	33	Married 11 years	0	25th	Profuse 3 days pain	+ Hypertrophy
17 021	34	Married 6 years	0	28th	Moderate 3 to 4 days pain	+ Hypertrophy
17 024	30	Married 4 years	0	28th	Moderate 3 days no pain	+ Hypertrophy

can be detected if the sections are quickly hardened (Fig 7)

A mere mention will suffice for certain other forms of gland change which are perhaps suggestive of pathological alteration, but which as a matter of fact are quite normal. For example, just after menstruation it is common to find transition types of gland, for during menstruation the dilated hypertrophic glands of the premenstruation under-

go a rather rapid crumpling and shrinkage to form the narrow glands of the postmenstrual period. Before the "emptying" of the endometrium is complete the glands often exhibit a peculiarly pleated lumen, which has given rise to the term "zieh harmonica-ähnliche drüsen." In the same way the invagination forms so often observed in the utricular glands were formerly looked upon as pathognomic of "endometritis glandu-



Fig 1 Gyn Path No 4 196 Endometrium from case of congenital anteversion. Curetting on fifth day of menstrual cycle. Menstruation moderate, 3 to 4 days, painful. No hypertrophic change. Glands narrow and straight.



Fig 2 Gyn Path No 19 361 Endometrium from case of congenital anteversion. Curetting on twenty-seventh day of cycle. Menstruation was rather profuse, 6 days, painful. Extreme glandular hypertrophy (premenstrual).

laris" (Himmelleher) Cullen and others, however, have shown quite clearly that these interesting and sometimes grotesque invagination appearances are produced by the manner of section of glands in which there is infolding or branching of the fundus.

The only previous study which I have been able to find on the relation of gland development in the endometrium to the clinical character of menstruation is by Buttner (7), whose paper is based on the analysis of 271 cases. Strange to say Buttner excludes from his study all cases in which the endometrium was removed after the twentieth day of the cycle, ostensibly because he wished to avoid consideration of cases in which there was premenstrual hypertrophy of the glands. He thus, to my mind, misses the real crux of the problem, for it is especially after the twentieth day that the gradually increasing effect of the menstrual stimulus upon the uterine mucosa is to be noted. His study is further vitiated by the fact that he groups all the endometriums together, making no effort to divide them according to the day of the menstrual cycle on which they were removed. Even so it appears that glandular

hypertrophy was found in the largest proportion in the cases in which menstruation was clinically profuse.

What interpretation shall we put upon this relation between the degree of glandular hypertrophy and the clinical character of menstruation? The fundamental cause of normal menstruation is a stimulus arising from the ovary, or at least dependent upon its activity. It is associated with a certain degree of endometrial hypertrophy, and clinically with a type of menstruation characteristic of the specific case. If, then, we find an inordinate degree of endometrial hypertrophy in a patient in whom menstruation is excessive, are we justified in concluding that there has been in such a patient an excessive discharge of the substance or substances which are fundamentally responsible for menstruation—more especially of the ovarian hormone or hormones? On the other hand, is it logical to assume that ovarian activity is deficient when we find that menstruation is scanty and glandular hypertrophy slight? Such conclusions would seem to be quite unimpeachable if we could exclude the possibility that the variations in the

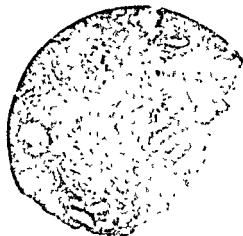


Fig. 1. Gyn. Path. No. 15120. Endometrium from case of congenital antelexion. Curetting on eighth day of cycle. Menstruation rather profuse but scanty part. Note the absence of extreme glandular hypertrophy.



Fig. 2. Gyn. Path. No. 15120. Endometrium from case of severe antelexion (infantile uterus). Curetting on eighth day of menstrual cycle. Menstruation moderate but scanty part. Note hypertrophy of glands in contrast with normal seen in Fig. 1, with which it should be compared.

character of menstruation are at least in part due to variations in some local factor in the endometrium. This is virtually a broadening of the result arrived at by Hirschmann and Adler, who concluded that uterine hemorrhage occurs only when the ovarian function is involved, and that it is never due to disease of the endometrium alone. For the evidence and arguments which they bring to bear on this problem I would refer the reader to their original paper.

The degree of endometrial hypertrophy in cases of antelexion. A rather surprising finding in the series of cases under study has been the fact that in cases of what might be called congenital antelexion the reaction of the endometrium to the menstrual stimulus is certainly not any less, and if anything is somewhat more marked, than in the cases of other pelvic disease of one form or another. The condition of congenital antelexion is commonly looked upon as indicative of a greater or less degree of arrest of development of the uterus, and in some of my cases indeed the uterus is described as of infantile type. Menstruation was more frequently scanty or moderate than profuse. Dysmenorrhea

was observed in practically all the cases, and in those of the patients who were married sterility was almost invariable. In spite of the hypoplasia of the uterus in such cases it was demonstrated that (1) in what may be called the quiescent portion of the menstrual cycle neither the glands nor the stroma exhibit any demonstrable differences in appearances or development from that observed in the fully developed or even the multiparous uterus at the corresponding period, (2) menstrual hypertrophy of the glands is noted at a comparatively early stage of the menstrual cycle, and may proceed to the development of the most marked premenstrual pictures, (3) such marked hypertrophy does not in this group of cases seem to bear any relation to the clinical severity of menstruation, for frequently the periods are described as scanty in amount.

Even though the uterus as a whole is hypoplastic, therefore there is no indication of incomplete development on the part of the endometrium. As a matter of fact it is more than ordinarily sensitive to the periodic physiological stimulation of menstruation. The real parenchyma of the uterus is the

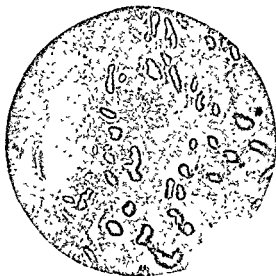


Fig 5 Gyn Path No 18911 Endometrium from case of bilateral salpingitis. Hysterectomy on eighteenth day of menstrual cycle corresponding therefore to case illustrated in Fig 3. Menstruation profuse, 6 to 7 days, pain. No hypertrophic changes in either gland or stroma.



Fig 6 Gyn Path No 19425 Endometrium from case of retroflexion, with cystic left ovary. Curettage, suspension and resection of left ovary on twentieth day of cycle. Menstruation of 3 weeks type profuse, 4 to 5 days, pain. Well marked glandular hypertrophy (premenstrual).

musculature, and it is this which exhibits the hypoplasia in these cases of congenitally defective development of the uterus. If it be true as seems to be indicated by the study of the first group of cases—i.e., those associated with various forms of pelvic disease—that the degree of endometrial reaction is a fair measure of the activity of the ovary, then certainly there is no diminution of the latter in these cases of congenital anteversion of the uterus. This is contrary to the generally accepted theory, for the scanty menstruation and the spasmodic dysmenorrhœa so commonly observed in these cases are usually explained as being due to deficiency of the ovaries. So far as I know there is no valid ground experimental or otherwise for the latter view. While the ovaries in such cases are sometimes rather small and beady, in other cases they are normal in size and appearance. Furthermore, we are all familiar with the fact that removal of one ovary, and perhaps also of a portion of the other is quite compatible with the continuance of normal and perhaps even quite profuse menstruation. Finally

the view that hypoplasia of the ovary must accompany hypoplasia of the genital canal receives no support from a study of embryology for the latter has an embryological origin quite different from the former. The ovary is developed from the so-called germinal ridge on the median surface of the wolffian body. On the other hand, the genital excretory system—i.e., the tubes, uterus and vagina—is formed from the junction of the two müllerian ducts, these in turn arising originally from the “genital ridge” on the ventrolateral surface of the wolffian body.

Bearing in mind these several facts, it is scarcely to be wondered at that the present study leads us to the conclusion that even in congenital anteversion or hypoplasia, associated with spasmodic dysmenorrhœa, scanty menstruation and perhaps sterility, deficiency of ovarian activity is not a *sine qua non*.

DOES THIS WORK SUGGEST AN EXPLANATION OF THE CHARACTERISTIC CLINICAL SYMPTOMS OF CONGENITAL ANTEVERSION?

A perplexing question presents itself at this point. If ovarian activity is not dimin-

ished in such cases, and if the endometrium exhibits well-marked hypertrophic phenomena, it would certainly seem that there must be a correspondingly marked menstrual hyperæmia of the mucosa analogous to that which is associated with similar hypertrophy of the endometrium in the well-developed uterus. Why, then, do we so frequently find scanty menstruation in cases showing perhaps extreme hypertrophy of the endometrium? The explanation which I would suggest is not based upon experimental data, and I offer it merely because it suggests future lines of work, while seeming to coincide with what we already know of the mechanism of menstruation. Without considering the latter in full, suffice it to say that hyperæmia of the uterine or endometrial blood vessels is not sufficient in itself to explain the exit of blood elements, especially of the red corpuscles, from the blood-vessels toward and into the cavity of the uterus. Such a phenomenon would clash with all our ideas as to the usual simplicity of the process of hyperæmia. Even in the most intense hyperæmia associated with inflammatory processes, there is no such wholesale exodus of red corpuscles from the blood-vessel lumina to the surrounding tissues. No consideration of the physiology of menstruation can therefore be complete without the assumption—though as yet it is little more than an assumption—that a rôle of much importance is played by some local factor in the endometrium which in some way increases the permeability of the blood-vessel walls to the usual blood elements of the menstrual discharge. Just what this factor is, how it is formed, and how it acts has not as yet been determined. Much work has been done and is now being done in an effort to solve this problem, but so far the results are rather indefinite, and in some respects chaotic. For a discussion of this subject I would refer to the works of Goffe (9), Sturmdorf (10), Adler (11), Cristea and Denk (12), and others.

If it be true, as the study of the present series seems to indicate, that in congenital antelexion there is no impairment of ovarian activity, the idea suggests itself that perhaps in these cases there is just as great a degree

of menstrual hyperæmia of the endometrium as in those in which the uterus is well developed, but that in the former it is the local factor which is defective—in other words, that there is a physiological as well as an anatomic deficiency in the uterus. In such cases menstruation may be much less than the average because the blood elements do not pass out from the blood-vessels with the same facility as in the entirely normal uterus. This hypothesis would seem to explain the characteristic pain observed in cases of this type, for an engorged endometrium, unrelieved by menstrual discharge of blood elements, might be expected to act as an irritant of uterine contractions much as a foreign body would. This conception is given further plausibility by the characteristic relief from pain which is noted as soon as the menstrual flow is well established. It is even possible that the sterility so often observed in those cases may in some as yet unknown way be dependent upon some local physiological deficiency in the endometrium.

The degree of bleeding, therefore is dependent, not only upon the degree of endometrial hyperæmia, but possibly also upon the degree of activity of the local factor concerned in setting free the blood elements from the blood-vessels themselves. In the uterus which is anatomically and physiologically well developed, the local factor is unimpaired, so that the degree of endometrial hypertrophy is an index of the activity of the ovary if this be conceded to be the organ responsible for the vasomotor phenomena of menstruation.

Speaking generally, the present study appears to indicate that the endometrium plays a subservient rôle in menstruation and that, with the exception of the one group of cases already spoken of it is the activity of the ovary that largely determines the clinical character of menstruation and the degree of hypertrophy in the endometrium. This is another way of saying that in cases of endometrial hypertrophy associated with profuse menstruation, the latter is the cause rather than the result of the hypertrophic changes in the endometrium. This conception is

not a new one. Many years ago Brennecke (13) described a group of cases of what he termed *endometritis ovarialis*, in which definite ovarian lesions were held to be responsible for the hyperplastic changes found in the endometrium. A similar explanation was offered in cases reported by Franz Czempin (14), Gottschalk (15), Winternitz (16), and Bulus and Kretschmar (17). The reports of all these authors, however, are invalidated by the fact that they took no account of the normal menstrual variations in the histology of the endometrium.

In the study described in the previous pages, however, in which due regard has been given to the physiological alterations in the endometrial histology, it seems to have been demonstrated that the endometrium plays a passive rôle, not only in normal menstruation, but in most of the pathological disorders of that process. Whatever the condition of the endometrium, whether normal or diseased, the constant and regularly recurring menstrual stimulus provokes characteristic changes in the labile endometrium, differing only in degree, as has been described in the body of this paper. If the function of the ovary be disturbed by general or local disease, if, in other words, menstruation is irregular, this characteristic histological cycle in the endometrium is correspondingly disturbed, with the production of atypical and sometimes confusing pictures in the endometrium. The "endometritis necrobionica" recently described by Driessen (18) is obviously produced in this way, as probably also the old "endometritis fungosa" of Olshausen. No discussion of these atypical cases, however, will be undertaken in this paper.

SUMMARY

The study of this rather large series of cases indicates, first of all, the general correctness of the teaching of Hitschmann and Adler as to the cyclical histological variations in the endometrium at different stages of the menstrual cycle. An interesting relation is shown to exist between the clinical character of menstruation and the degree of endometrial hypertrophy called forth by the menstrual stimulus. Speaking generally, the



Fig 7. Gyn Path No 7026 (after Cullen). Hyperplasia of endometrium. Note dilatation of some of glands without flattening of the epithelium. The stroma between the glands is dense. "Given such a mucosa as this, one can say with almost absolute certainty that the patient has had very profuse menstrual bleeding" (Cullen).

more profuse the menstrual flow the more marked the local hypertrophic changes in the endometrium. The less abundant the flow the less striking the local reaction in the endometrium. The latter must, therefore, be looked upon as playing an essentially passive rôle in menstruation.

An important exception to the above generalization is encountered in cases of ante-flexion of what is commonly spoken of as the congenital type. In this group hypertrophic changes are, if anything, more marked than those noted in association with other pelvic conditions. This would indicate that the ovary, whose activity appears to govern the degree of hyperæmia and of consequent endometrial hypertrophy, is not functionally deficient in such cases, as has so often been

stated. The scanty menstruation so commonly observed in cases of this type is perhaps due to a deficiency in a local factor whose activity permits of the passage of blood elements from the vessels toward and into the uterine cavity. Such a theory would seem also to explain the spasmodic dysmenorrhea so characteristic of congenital ante-flexion, for the engorged mucosa, acting as an irritant to the uterine musculature, gives rise to spasmodic and painful contractions of the latter.

Sterility is also extremely frequent in association with congenital ante-flexion. It is possible that future work may show that this is also in some way due to a physiological rather than an anatomical deficiency in the uterus.

On the whole the studies recorded in this paper, while in themselves along anatomical lines, tend to emphasize the fact that the physiological factor is of much greater importance in the consideration of menstrual

disturbances than mere defects or alterations in the anatomic structure of the generative organs.

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PRIMARY CARCINOMA OF THE APPENDIX

A REVIEW OF THE LITERATURE, WITH A REPORT OF THREE ADDITIONAL CASES¹

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CARCINOMA of the appendix which up to 1896 had scarcely been reported, has now a fairly extensive literature. Under the circumstances the placing on record of three additional cases might hardly seem justifiable were it not that so much confusion exists as to the exact place, both clinically and pathologically, the lesion should occupy that every case should be reported in detail in the hope that a careful sifting and comparison of large numbers of accurate reports may help to clear up the subject. Up to the present time the question has been of more interest to the pathologist than to the clinician because of the relative non-malignancy of the condition but the possible causal relation of carcinoma of

the appendix to some cases of cæcal carcinoma and the report of an occasional undoubtedly malignant primary carcinoma of the appendix make the study of the condition of more than academic interest even to the clinician.

Before reviewing the recent literature on the subject I wish to report the three following cases operated upon at Beth Israel Hospital, New York City. Case 1 being operated upon by Dr. Henry Mann Silver, Cases 2 and 3 by the writer.*

CASE 1. M. I. male, age 31, operated upon October 16, 1912. History of indefinite abdominal pains more marked on left side. Exploratory laparotomy. Nothing found except an appendix with a hard, bulbous end. Appendectomy.

*Service of Dr. Richard L. Lewinsohn.

¹ Read at a meeting of the Metropolitan Medical Society of New York held at the Academy of Medicine, May 25, 1912.

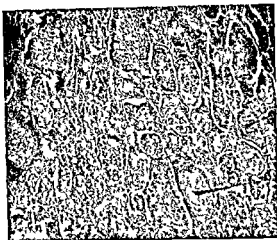


Fig 1 a Tumor b remains of lymph nodes

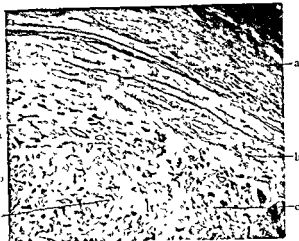


Fig 2 a Muscular layer, b submucosa, c tumor

Pathological report (No 3475) by Dr Eli Moschowitz pathologist October 16 1912 Specimen Appendix *Gross examination* The appendix is 7 cm long 1 cm in average diameter the distal end 2 cm and bulbous The peritoneal surface is smooth except at the bulbous portion where there are a few small nodules

Transverse section through the bulbous portion shows it to be occupied by a solid growth occupying the entire lumen and surrounded by both muscular coats to which it is intimately connected Longitudinal section shows tumor extending throughout the entire bulbous portion and slightly above it where it merges rather sharply into the walls of the appendix The tumor is firm fibrous in appearance light yellow brown The remainder of the appendix shows a slightly dilated lumen, otherwise normal

Microscopic examination The tumor shows an elongated structure imbedded in a concrete tissue stroma The alveoli are irregular in size and shape but the vast majority are circular or irregularly oval The alveoli are filled with irregularly shaped cells of the epithelial type The cell bodies are pale, the nuclei are round fairly uniform in size vesicular and fairly rich in chromatin A few mitotic figures are discoverable The connective tissue stroma is slight in extent compared to the epithelial element it is fibrous and rich in eosinophile cells

The tumor has invaded the muscular coats in all directions and in one portion the mesenterium also shows slight infiltration Scattered throughout are a number of lymphatic foci apparently the remains of the lymphoid tissue of the organ The remainder of the appendix is normal (Fig 1)

Diagnosis Medullary carcinoma

CASE 2 M G female age 10 operated upon February 1 1914 History of attacks of pain in right iliac region for past four years During past

year attacks very frequent and recently almost daily

Pathological accession No 4670 February 25, 1914 Specimen Appendix *Gross examination* Appendix is 5 cm long, diameter of a lead pencil, is uniform in thickness from the top to the base The peritoneal surface is smooth, no adhesions Section of the tip reveals a firm, solid mass occupying the lumen, surrounded by the muscular coat of the appendix This mass is circular measures 5 mm in diameter about 10 mm longitudinally, and can be shelled with slight difficulty from the appendicular wall Sections through the remainder of the appendix show a very narrow lumen throughout the entire length

Microscopic examination The tumor consists of numerous small alveoli filled with epithelial cells enmeshed in an abundant connective tissue stroma The epithelial cells are small and spherical the nuclei are uniform in size and circular and are rich in chromatin No mitotic figures are visible The connective tissue is more abundant than the epithelial elements and consists of many connective tissue fibers and a moderate number of connective tissue cells The growth is limited within the muscular coats of the appendix and does not penetrate between the muscular fibers The remainder of the appendix is normal (Fig 2)

Diagnosis Carcinoma simplex (scirrhous)

CASE 3 E C, female age 15, admitted November 27 1914 to the hospital during an attack of acute appendicitis (first attack) Temperature 103.6° pulse 136 Evidence of free fluid in peritoneal cavity Leucocyte count 34,000, 66 per cent polynuclear cells Operation removal of gangrenous appendix drainage

Pathological accession No 5406 November 27 1914 Specimen Appendix *Gross examination* Appendix 5 cm long 1 cm in thickness, peritoneal surface is deeply congested thickened irregular and



Fig. 3 a Muscle fibers, b tumor

covered with fresh fibrin. The tip is bulbous, soft, partially necrotic and contains a very much dilated lumen filled with pus. Proximal to the tip the appendix upon section reveals an intensely inflamed mucosa with infiltrated wall, especially beneath the peritoneal coat. The remainder of the appendix down to the base reveals a narrow lumen with infiltration of the muscular coats.

Microscopic examination. Sections were made (1) from the bulbous portion, (2) just above the bulbous portion, (3) near the base. (1) Section from the bulbous portion reveals the usual changes associated with an intense, acute, suppurative inflammation. The mucosa has been entirely destroyed. (2) Section just above the bulbous portion also shows acute suppurative inflammation. In addition, however, there is an alveolated epithelial tumor situated in the subperitoneal tissue. This area is crescentic in shape and extends around the appendix for about a third of its circumference. The tumor consists of smaller and larger irregularly shaped alveoli filled with cells of an epithelial type. The cells are irregular in size and shape, the outlines are indistinct, the nuclei are large, vesicular, and fairly rich in chromatin. No mitotic figures are present. The growth has penetrated into both muscular layers and partly also into what is left of the submucous connective tissue. In the latter situation the carcinomatous alveoli show partial necrosis due to the accompanying intense acute inflammation; the mucosa is completely absent and the lumen of the appendix is filled with an exudate. The connective-tissue elements of the tumor are fibrous, with few fibroblasts and in extent about equal to the epithelial content. (3) Section through

the base shows a fairly recent acute suppurative inflammation of the appendix (Fig. 3).

Diagnosis. Carcinoma simplex, with acute suppurative inflammation.

DIAGNOSIS

The pre operative diagnosis is either an acute appendicitis (as in Case 3), a chronic appendicitis (as in Case 2), or the diagnosis is doubtful and the operation exploratory (as in Case 1). Carcinomatous appendices are occasionally removed during the course of an operation performed for another condition (as hysterectomy), and occasionally, though rarely, found at autopsy in patients who gave no history of appendicular trouble.

FREQUENCY

These three cases occurred in a series of 707 consecutive appendectomies, performed for either acute or chronic appendicitis, though a fair number of appendices were removed during laparotomies for other conditions. This means a percentage of about 0.42 of carcinoma of the appendix, all appendices removed being microscopically examined. In the literature the percentages reported vary from 0.33½ per cent to 1 per cent. The Mayo Clinic at Rochester, Minnesota, recently reported 40 cases in a series of 8039 consecutive cases, or about 0.5 per cent.¹

HISTORY AND LITERATURE

The first case of carcinoma of the appendix on record is that reported by Merlín in 1838, in 1865 Priéri reported another, in 1867 Rokitsky reported four cases of colloid tumor of the appendix. Up to 1895 twelve cases had been reported, only one of which had been histologically described. During the next eight years only six cases were reported, for Moschcowitz (23), in an article in the *Annals of Surgery*, 1903, was able to collect only 18 cases in the literature, to which he added three more of his own. Elting in the same year reported three additional cases. By 1906 the number of cases reported had grown to 36 (Rolleston and Jones, 33), Zaayer in 1907 reported 60 cases, including eight of his own previously published. Since

¹ In a personal communication dated March 3, 1915, Dr. MacCarty of the Mayo Clinic says that up to date he has seen 45 cases of carcinoma of the appendix, that is, five additional to those previously published.

When reports have been very frequent, because both surgeons and pathologists have been on the lookout for the condition. Today in many hospitals all appendices removed are histologically examined, and in many others where this routine is not followed any appendix at all suspicious of tumor is examined, the condition is, therefore, much more frequently recognized than formerly.

In 1908 McWilliams (27), in a careful review of all the literature, collected and reported 105 cases, including his own. In 1913 Batzdorf and Graham (9) reported 170 and 172 cases respectively, the latter writer reporting six of his own (H. Joseph, however, in 1911 had reported 186 cases, so that these writers evidently overlooked some cases). Rogg (34) in 1913, in an exhaustive article, collected 201 cases. Since then I have been able to collect from the literature reports of 65 cases, as follows: Ries (37), Barclay (5), each one case, Schwartz (40 and 41), Baldauf (4), each three cases, Hada (10), six cases, Addison (3), one case; Graham (9), six cases, Miloslovich (24), three cases, MacCarty and McGrath (28 and 29) forty cases, Hanke (12), one case.

These sixty five cases (together with the three reported by me), added to Rogg's 201, make a total of 269 cases on record at the present time. That the condition will frequently be missed, when only those appendices are microscopically examined which are suspicious of carcinoma, may easily be understood when one notes that of the 40 cases reported by MacCarty and McGrath only 10 per cent were suspected even after careful examination of the gross specimen. This fact helps to explain why, in four thousand routine post-mortems by Nothnagel and Maydl in the Allgemeine Krankenhaus, only two cases of carcinoma of the appendix were found.

Considering the age incidence, sex, frequency, symptoms and diagnosis, treatment and prognosis, the literature contains few differences of opinion, it is only when the pathology is considered that differences are found. The following is a brief résumé of facts gleaned from an extensive review of the literature.

Age. The majority of cases reported occurred in the third decade, and a good many in the second and fourth. A few cases were reported under ten years of age: one by Rogg (age 6 years) in 1913 and another by MacCarty and McGrath (age 5 years) in 1914. The oldest case was 81 years of age, reported by Rogg.

Sex. More cases are reported in females than in males (60 per cent to 70 per cent). This phenomenon is probably explainable by the fact that women furnish the pathologist with more appendices for examination than men because of the prevalent practice of removing the appendix during laparotomies for gynecological conditions. MacCarty and McGrath (29), in their last paper on the subject, report that 73 per cent of their forty cases of carcinoma of the appendix occurred in the female. If, as the majority of writers believe, carcinoma of the appendix is a sequel to inflammation of the appendix, it ought to be more frequent in men, as between 60 per cent and 70 per cent of appendicitis patients are men.

Symptoms and diagnosis. Most cases of carcinoma of the appendix are found in patients who have given symptoms of either an acute or chronic appendicitis. Some are found during the course of an exploratory operation for indefinite symptoms, the appendix being removed either because of a suspicious bulbous tip or hardness or as a matter of routine. Occasionally an apparently normal appendix, removed during an operation for some unrelated condition (as hysterectomy), is reported as carcinomatous by the pathologist. No authentic case in which a pre operative diagnosis was made is on record. The only case reported in the literature in which it was claimed that the diagnosis was made before operation is the one reported by von Beger (6) and operated on by von Thiersch. Considerable doubt exists as to the actual condition present here. There was a palpable tumor and a sinus leading to a cancerous appendix, the case is considered by E. Muller as a cal carcinoma, but by some others as a cancerous appendix projecting into the cavity of the cæcum but not actually involving its walls (McWilliams 27).

Treatment When in the course of a laparotomy an appendix is found which is at all suspicious of carcinoma it should, of course, be removed. In fact, without entering into a lengthy discussion as to the advisability of appendectomy in all laparotomies, a disease incidence of 0.5 per cent, such as exists in this condition (aside from other reasons usually given), might be considered sufficient argument for recommending the removal of even apparently normal appendices. As carcinoma of the appendix occurs most frequently in appendices that are the seat of an acute or chronic appendicitis, which is the trouble that brings the patient to the surgeon, the appendectomy performed as part of the treatment of the appendicitis is, of course, the proper treatment for the other condition present. The report of the pathologist is usually the first inkling the surgeon has that he has removed a carcinoma of the appendix.

Prognosis The prognosis is very favorable in a very large percentage of cases. Occasionally a type occurs in which the prognosis is not so favorable. The characteristic of this type will be discussed under the next heading.

Pathology There is considerable difference of opinion as to the exact place of carcinoma of the appendix in relation to blastomatous development. In fact, some pathologists do not consider these growths as carcinomata at all. The points of agreement are as follows:

1. The growth is a very benign type rarely spreading or making metastases.
2. It occurs most commonly in the third decade of life and is quite frequent in the very young, thus differing from the usual type of carcinomata.
3. It is more frequent in the female sex. While this view has been held by all writers to date, it probably needs revision.
4. The disease usually starts in the mucosa, its most common site is at or near the tip (90 per cent).
5. It occurs usually in an appendix which is, or has been, the seat of an appendicitis, and most commonly at the site of a stricture. There is a difference of opinion as to whether the carcinoma or the stricture is primary.

Most authorities regard the inflammatory condition as primary and base their view upon the arguments that in other carcinomata of the intestinal tract complete obliteration of the tumor mass never occurs. The general consensus of opinion, therefore, is that the stricture is primary. Inasmuch as obliteration is probably always due to inflammation, a previous appendicitis may be considered the remote cause of cancer in the appendix, just as gastric ulcer, cholecystitis, lip and tongue fissures and ulcers are the precursors of cancers. Milner (20), however, dissents from this view, considering the stricture secondary. His entire conception of the condition differs from most writers, as he considers the growth an inflammatory proliferation of the lymphatic vessel endothelium, a hyperplastic chronic lymphangitis, and has applied to it the term pseudocarcinoma or carcinoma analogus to the "Carcinoid Dunndarmtumoren" of Obendorfer. These tumors are all made up of epithelial cell groups, usually in the submucosa, but sometimes extending to the peritoneum, and are without clinical significance. Aschoff (1 and 2) calls them "Schleimhaut Nævi," or nævi of the mucous membrane, and while laying stress on their benignancy, thinks that occasionally they may change their characteristics and become malignant in the same way as nævi in other situations. Marchaud (21 and 22) and Dietrich (8) both consider the growth as a genuine epithelioma.

Rogg (34) considers these "Schleimhaut Nævi" as typical carcinomata and sees no reason to question this conception because of the clinical picture, pointing out that there are all grades of malignancy from the relatively benign rodent ulcer to the malignant type of gastrointestinal carcinoma. Furthermore, whereas practically all these cases are benign,¹ sight must not be lost of the fact that malignant cases have been reported. In the majority of these cases the cæcum is involved, and doubt, therefore, exists as to whether the growth was primary in the cæcum or in the appendix. But there are some undoubted cases of primary carcinoma of the appendix in which metastases and death have occurred.

¹ None of the forty-five cases observed at the May Clinic showed any extension or metastases. (Personal communication from Dr. MacCarty March 3, 1915.)

It is also probable that some, though few, cases of caecal carcinoma are secondary to a primary growth in the appendix, though MacCarty, in a report of twenty cases of carcinoma of the caecum, found only one which may have been secondary to a primary growth in the appendix.

Lejars (16) reported a case supposedly limited to the appendix at the time of operation, followed by recurrence within three months. This is the first undoubted case of recurrence following operation for this condition in which the appendix alone was involved at the primary operation and in which diagnosis was confirmed by microscopic examination. Two cases were reported one each by Lanz (17) and Ruyter (38), in which the appendices were not microscopically examined, but the recurrences were microscopically carcinomatous. Because of cases like this, and also because of the occasional though rare presence of involved glands in the meso appendix, McWilliams advises a wide removal of the meso-appendix in all appendectomies instead of its removal close to the appendix, as is frequently practised.

Luce (18) collected twenty-three malignant cases and reported two of his own, only ten of these he considered as undoubtedly primary in the appendix, the origin of the remaining cases was doubtful. G. C. Ross (36) reported a very interesting case two years ago, somewhat analogous to Lejars' case but with a much more rapid development. There was a history of chronic appendicitis, and an appendectomy was done, the lymph nodes of the meso appendix were enlarged. One week after discharge from the hospital the patient was readmitted with a large mass in the lower abdomen and one in the abdominal wall. Microscopical examination of these masses showed carcinoma of the same type as that of the removed appendix.

As gleaned from the literature there are various types of growth found in these cases. According to some writers the character of the cell is different in those cases that have been followed by metastases. The majority, however, make no attempt at differentiation of pathological types but content themselves

with emphasizing the non-malignant character of the condition and refer only casually to the possibility of metastases in rare cases.

The following types have been reported:

1. Colloid carcinoma of the appendix (4 per cent).

2. Small, round celled or spheroidal celled carcinoma, carcinoma simplex or scirrhus, the most common form, and usually the type in young. Non-malignant (53 per cent).

3. Cylindrical-celled carcinoma—occasionally but rarely followed by extensions or metastases. This form is much less common than the second and resembles in character the ordinary type of intestinal cancer (23 per cent).

4. Mixed types (4 per cent).

5. Endothelioma (37 per cent).

6. Transition forms (10 per cent).

While in the above classification an attempt is made to indicate which type is more malignant, I hardly think it worth while to place any reliance on this, as the evidence is altogether too meager.

Miloslowich (24) however, insists that one must not lose sight of the fact that there are two distinct types of this condition "a small non-malignant tumor and a cylindrical-celled cancer which in its anatomic and histologic as well as clinical picture is similar to cancer (*drusen Krebs*) in other parts of the intestinal tract." Graham (9) in an article reporting 172 cases of which 35 belonged to the columnar celled type refers to 6 malignant cases among these 35 reported by Beger, White, Voelckler, Neugebauer, Bertels and Marsh.

SUMMARY

The whole matter may be summed up as follows:

That in carcinoma of the appendix we have a condition formerly believed to be very rare, but now known to occur in about 0.5 per cent of all removed appendices. It is a condition never recognized before operation and usually unrecognized at the time of operation. (Only about 10 per cent of removed appendices are suspected before being sent to the pathologist.) Furthermore while up to the present time the condition has been

¹ Classification and percentages as in article by McWilliams (27).

considered as histologically malignant, but clinically benign, it must be recognized that clinically malignant cases do occur. The condition is therefore of sufficient importance to warrant intensive study of all cases. Only by such study can our knowledge be increased, so that some day a clinical diagnosis may be possible. It is not impossible that some carcinomata in the abdomen in which no primary growth is discoverable, e.g., carcinoma of the peritoneum, a non epithelial organ, may be secondary to carcinoma of the appendix.

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A SIMPLIFIED METHOD OF BLOOD TRANSFUSION WITH REPORT OF SIX CASES OF PERNICIOUS ANÆMIA TREATED BY MASSIVE BLOOD TRANSFUSION AND SPLENECTOMY¹

By NELSON MORTIMER PERCY, M.D. F.A.C.S. CHICAGO

IN September 1913 the writer encountered a case of septicæmia in a child on which it seemed wise to make a blood transfusion. Previous to this time I had used Crile's method of direct transfusion, but on account of technical difficulties and the uncertainty of the amount of blood being

given, if any, the method had not proved satisfactory in my hands. This method was especially contra indicated in this patient, because of the likelihood of contaminating the donor from the recipient.

In the *Journal of the American Medical Association* of July 12 1913 Kampton de-

¹ Read before the Chicago Surgical Society May 7 1915

scribed an indirect method of blood transfusion, by draining off blood from the radial artery into a paraffin-coated tube, designed by Brown, and injecting this blood into the median basilic vein of the recipient. The tube to be described is a modification of the Brown tube, which was modified with the object of making a venous transfusion tube and also a tube more easily constructed. The tube consists of a glass cylinder 4 cm in diameter, with a cannula leading from one end, the other end being drawn out into a tube about one cm in diameter to which a Y connection is made. To one arm of the Y, a rubber tube is attached for suction to aid in filling the tube, and to the other arm a rubber bulb is connected to aid in injecting the blood. The tube differs from the Brown tube in that there is no side tube coming off from the cylinder, and the upper end of the cylinder, instead of being closed with a large cork, is drawn out into a tube for the Y connections as described above. The cannula part of the tube is so constructed that it can be inserted directly into the vein of the donor and then the recipient. An open dissection of the vein of both donor and recipient is made for two reasons. First if the operation were done subcutaneously it would be necessary to use a needle with a rubber connection to the cannula which connection would make a roughened area which would favor clotting, whereas, with the smooth, paraffin coated cannula there is no such tendency. Second after the tube is filled with blood, the cannula can be inserted into vein of the recipient without delay, an essential feature after blood has been withdrawn.

The dangers of transfusion are two, i.e., immediate and delayed. The immediate dangers are embolism either from air or clotted blood or acute dilatation of the heart consequent to such rapid inflow of blood that the recipient's heart is overwhelmed. The delayed danger is that from hæmolytic, which danger cannot always be eliminated by the most careful tests prior to the operation.

A hæmolytic test of each blood upon the other should be made before transfusion because it has been found that in a small percentage of cases there is a tendency of the

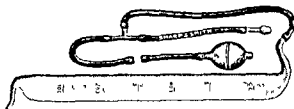


Fig. 1. Instrument used in indirect method of transfusion of blood.

serum or corpuscles to cause a disintegration of the red cells of the blood from another individual even when the latter be a near relative. This is especially likely to occur in cases of tuberculosis. Crile states that it happens in 5 per cent of patients suffering from tuberculosis. Bernheim states that in 800 reported transfusions there were fifteen instances of macroscopic hæmolytic. In these fifteen cases there were eleven recoveries and four deaths. No hæmolytic tests were made in three of the instances where death occurred. In the fourth case tests were made, and it was known that the donor's cells were slightly agglutinated by the patient's serum but since agglutination is an entirely different process from hæmolytic it was considered fairly safe to use this donor and a fatality occurred. Tests were made in eleven of the fifteen recoveries and in nine instances hæmolytic was prognosticated.

The writer's experience with both hæmolytic and agglutination tests differs from these findings. In both of the cases where fatal hæmolytic occurred the hæmolytic tests were absolutely negative. In the patient who showed slight reaction, both the hæmolytic and the agglutination test, as described by Rous and Turner, were perfectly negative. In another case which showed a beautiful, unmistakable agglutination (Rous Turner) but negative hæmolytic transfusion of 800 ccm of blood was performed, smoothly and without the slightest sign of any discomfort to the recipient. Only once has the hæmolytic test been positive. In view of these facts the author deems it essential to make, in addition to these tests a preliminary transfusion of 20 ccm of blood, believing that this amount of blood will indicate hæmolytic, if it is to occur, without serious sequelæ.

Besides making a test for hæmolytic, a careful history should be obtained from the donor, and if at all suspicious, a Wassermann reaction should be made. Donors should not be chosen from persons giving a history of recent attacks of typhoid fever, pneumonia, diphtheria, tonsillitis, malaria, or influenza, or from persons suffering from tuberculosis, chronic arthritis, rheumatism, or where there is a history of hæmophilia.

The agglutination test we use is that described by Rous and Turner.¹ The hæmolytic test we use is as follows. Ten ccm of blood is collected from a vein of the donor (D), 5 ccm of which is placed in a dry centrifuge tube and allowed to clot and the remaining 5 ccm mixed thoroughly with 10 ccm of a one-half per cent sodium citrate solution in normal salt solution. The latter solution preserves the red cells and prevents clotting. Both tubes are now rapidly centrifuged. In one tube the clotted blood will separate, leaving a clear serum as an upper layer, 1 ccm of this serum is then added to 9 ccm of normal salt solution in a test tube and labeled 10 per cent solution of D's serum. The other centrifuge tube now contains a compact layer of red cells in the bottom and an upper clear layer of mixed serum and salt solution. This upper layer is carefully poured off and the same amount of fresh normal salt solution is added with a pipette so as to mix the cells. The tube is again centrifuged. This procedure is repeated ten or twelve times in order to thoroughly wash the red corpuscles free of serum. Finally, 1 ccm of the corpuscles is mixed with 9 ccm of normal salt solution in a test tube and labeled 10 per cent suspension of D's corpuscles. Ten ccm of blood is collected in the same way from the recipient (R), and a 10 per cent solution of serum and a 10 per cent suspension of cells are prepared as above and placed in separate test tubes. These four 10 per cent solutions and suspensions are used in setting up the test.

In a clean test tube 1 ccm of D's serum is mixed with 1 ccm of D's corpuscles. In a second tube 1 ccm of R's serum is mixed with 1 ccm of R's corpuscles. These two

tubes are used as controls. In a third tube 1 ccm of R's serum is mixed with 1 ccm of D's corpuscles. These four tubes are placed in the incubator at 37.5° C. for two hours, during which interval the tubes are shaken several times. They are then placed in the ice-box for twelve hours and shaken occasionally to insure mixing. If the blood cells remain as a layer in the bottom of the test tubes and there is a clear, nearly colorless fluid above, or if the tube, when shaken, be quite cloudy and not transparent, there has been no hæmolytic. If there are no red cells present as a layer, or if the shaken tube is clear, there has been hæmolytic of the red cells. The two control tubes should show no hæmolytic. If they do, there has been an error in technique.

PREPARATION OF TUBE

The tube should be cleansed by washing with water, alcohol, and then with ether, and, after it is perfectly dry, two ounces of melted grocer's paraffin is poured into the tube through the upper end. It is then wrapped in a towel and placed in a steam autoclave for fifteen minutes under fifteen pounds of pressure, after which, with sterile rubber gloves over the hands, the tube is rolled around while cooling so that every part of the inside is covered with melted paraffin and any excess allowed to run out of the large end "D". Care should be taken not to allow the cannula to become plugged with paraffin. If it does the tip is warmed over a flame and the paraffin allowed to run back into the tube. Sterilizing the rubber tubing glass Y, and mouth piece is done by placing them in a towel and autoclaving in the same way and at the same time as the transfusion tube, or boiling them for twenty minutes. The atomizer bulb is thoroughly washed with alcohol to sterilize it. When ready to use, the connections are all made and two ounces of sterile liquid paraffin aspirated into the tube through the cannula by means of suction at the mouth piece.

TECHNIQUE OF TRANSFUSING THE BLOOD

The arms of both the donor and the recipient are prepared as for surgical operation.

Proper constriction of the donor's arm is essential if one wishes to draw off a large quantity of venous blood rapidly. Constriction by means of a rubber tube is not satisfactory because the amount of pressure is not known, nor can the pressure be varied as desired. An ordinary blood pressure apparatus placed about the arm and pumped up to 60 to 80 mm of mercury, depending upon the rapidity with which the blood flows, makes an excellent constrictor. By this means the venous circulation is impeded, but not the arterial. It is imperative to use a separate set of instruments on different tables for donor and patient in order not to transmit infections from patient to donor. Under local anesthesia, using one-half of one per cent novocaine solution intradermally, an incision is made over the cephalic vein just above the elbow on both the donor and the recipient, and a ligature placed about the vein in its proximal portion in the donor and in its distal portion in the recipient. Small Carrel clamps are placed on that portion of the vein away from the ligature in each patient and a longitudinal incision 3 mm long made through all coats of each vein midway between clamp and ligature. Small retention clamps are placed on the two edges of the incision in each vein in order to hold them open. The cannula is placed, pointing distally into the vein of the donor, and the Carrel clamp released from the vein. By means of suction at the mouth piece, venous blood is drawn into the tube up to the required amount. The blood is well protected from the sides of the glass by the paraffin coat and from the air by the liquid paraffin which floats over and completely covers the blood. As soon as the tube is filled, which in our experience averages about three and one half minutes to withdraw 600 ccm of blood, the aspirating tube is clamped, the cannula removed from the vein and the small clamp reapplied to the donor's vein.

The cannula is now quickly placed in the lumen of the vein of the recipient and the Carrel clamp released. The blood will now flow into the vein of the recipient toward the heart, the velocity of which flow may be controlled by careful pumping of the rubber

atomizer bulb. As soon as it is evident that the blood is flowing properly, an assistant may release the constrictor from the donor and ligate the vein distally to the opening from which the blood has been taken. Not more than five minutes should be utilized in obtaining the blood, nor more than five minutes in injecting it. The length of time required to fill the tube with blood varies with different donors. It is well to have two tubes ready, so that if it is found that the first tube fills slowly, taking more than five minutes to get the required amount, the process may be repeated with second tube, aspirating only the remainder of the required amount of blood.

QUANTITY OF BLOOD

In cases of hemorrhagic purpura and hemophiliacs small quantities of blood give results. For other conditions large quantities of blood such as 500 to 1000 ccm are indicated. In cases of acute shock accompanied by considerable loss of blood, 1000 ccm may be given with advantage, while for the chronic conditions it is our custom to give 500 to 850 ccm at one time. The amount given to children varies with the age, similar to the dosage of drugs.

INDICATIONS

Some of the conditions in which the blood transfusion therapy may be considered are splenic anemia with hemorrhages, secondary anemia of both known and unknown origin, in pernicious anemia where its effect is merely temporary unless combined with splenectomy, in purpura and hemophilia, acute surgical shock especially in emergency cases where it is necessary to perform major operations, as a preliminary measure to decrease the surgical risk in debilitated patients on whom major operations are contemplated, such as extensive stomach and intestinal resection for carcinoma, and to aid post-operative convalescence in debilitated patients like cases of surgical tuberculosis.

REACTION TO TRANSFUSION

The majority of patients have not experienced any noticeable reaction although a few have had some temperature and an

occasional chill. Our observations in this do not coincide with those of Lindeman, that the reaction from a blood relative in most instances is less than from an alien, *vide infra*. The immediate effect upon the patient is usually quite striking. They describe a sensation of being stimulated, and within twenty-four hours develop an enormous appetite. The feeling of stimulation persists for several days.

NUMBER OF TRANSFUSIONS

Since September 1913 the writer has made fifty-four blood transfusions by this method, the technique of which has been perfectly satisfactory. The writer has met with definite hæmolytic in two cases, and a slight reaction in a third case.

The first case was a patient with tuberculosis. A marked hæmolytic reaction existed between her blood and her husband's, but a test with the sister's blood was negative, so she was chosen as the donor. Five hundred ccm. of blood was taken from the donor, and after about 250 ccm. had been given to the recipient she suddenly complained of a peculiar feeling over her entire body and of pain low down in the spine radiating down along both sciatic nerves. The transfusion was stopped immediately without giving the remaining 250 ccm. of blood in the tube. Chills and vomiting began at once. A peculiar bluish pink blush flushed the woman's face and body being strikingly intense on the palms. Sweating, so profuse that droplets formed on the fingers and the palms glistened was noted immediately. Great respiratory distress accompanied these signs, persisting somewhat longer than the characteristic blush which quickly changed to a transient cyanosis, as though the capillaries had been suddenly gorged to their absolute capacity and then had suddenly contracted to their utmost. This entire chain of symptoms occurred within three minutes of the beginning of transfusion. The vomiting and chills persisted in their full intensity for about one hour, when the temperature mounted to 101°, returning to normal within 24 hours. The vomiting continued regardless of food (bile and mucus), at intervals of from a half to a few hours. Two hours after the transfusion bleeding began from the uterus and the small cutaneous wound in the arm, and it was uncontrollable except by tight compression of entire arm and heavy sealing of the wound with collodion. Bleeding subsided within twelve hours.

Six hours after transfusion, a peculiar yellow color, different from, yet suggesting, jaundice made its appearance over the entire body, including the sclera. This color disappeared in thirty-six hours. For the thirty-six hours following the transfusion there was complete suppression of urine.

One week after transfusion, an urticaria appeared over the entire body persisting for about a week and being replaced by a peeling resembling the scaling of a scarlet fever rash. Constant nausea and vomiting persisted without abatement. Patient gradually lost strength and died at the end of three weeks without evidence of any terminal infection.

The second patient showing hæmolytic was a woman of 40 having a severe secondary anemia due to long continued bleeding from an infected fibroid uterus, complicated by gall stones impacted in the cystic duct. Hysterectomy was done. Two weeks later the patient experienced severe gall stone symptoms, but was still in such an anæmic condition that removal of the stones was impossible, so blood transfusion was planned. Hæmolytic tests being negative, transfusion from her husband was attempted. After 250 ccm. of blood were given, practically the same set of symptoms as described above appeared except that the tendency to bleed was absent. The patient vomited continuously and died in twenty days.

Autopsy showed no sepsis of any sort. There were petechial hæmorrhages in the skin, scaling, and dryness. The liver was large, yellowish, and showed perilobular fatty infiltration. The kidneys showed hæmorrhagic interstitial nephritis with cloudy swelling. The spleen was bluish and somewhat large. The heart-muscle showed marked fatty degeneration with great hæmachromatosis. The marrow of the long bones was perfectly colorless, greasy and showed complete absence of blood forming elements. The cystic duct contained four impacted stones, the gall bladder being small and full of stones. The other organs were negative.

The third patient, a case of severe pernicious anemia, showed only slight symptoms of hæmolytic. The main interest being in the relation of the tests to his reactions.

His first transfusion was of 600 ccm. with his son as donor (hæmolytic test negative, Rous Turner agglutination test positive), from which transfusion no untoward effects were noted. One week later, after receiving 250 ccm. of blood from his daughter (tests both negative), the same symptoms of hæmolytic as described above in patient No. 1 took place immediately, but with less intensity. Instead of total suppression of urine, he had a marked hæmaturia for twenty-four hours. There was no vomiting after the first four hours. At the end of 24 hours he had completely recovered from all symptoms of hæmolytic.

One week later he received 700 ccm. of blood from son again with no untoward symptoms except violent vomiting for 15 minutes and almost immediate copious purging. Another week later, he received 600 ccm. of blood from an alien with absolutely no untoward symptoms whatsoever.

One case of profound pernicious anemia with apparent cure eighteen months after

treatment by combined massive blood transfusion and splenectomy follows

Patient was 45 years of age — always in good health until February, 1911. Entered hospital June, 1912, nineteen months after onset of illness. At this time her red blood count was 896,000, white count 5,000, hemoglobin 40 per cent. Remained in hospital five months, during which time she picked up and did fairly well. When she left the hospital, September, 1912, her red count was 2,350,000, white count 7,000, hemoglobin 55 per cent. After being home five weeks she went down again, losing fifteen pounds in one month. She entered the hospital again October 4, 1912 when the hemoglobin was 30 per cent, reds 1,400,000 and whites 6,000 and remained in bed for six months her condition keeping about the same. In the summer of 1913, patient was somewhat better. Then all her symptoms reappeared, and she became worse in spite of all medical treatment. January 1, 1914 the patient was extremely weak, had general edema, dyspnea, and her gastric symptoms became so bad that she was unable to retain even water. On January 16, 1914, she weighed only 105 pounds, the red count was 868,000, whites 3,200 hemoglobin 25 per cent. A differential count showed polymorphs 54 per cent, large lymphocytes 17 per cent, small lymphocytes 20 per cent, transitionals 6 per cent eosinophiles 2 basophiles 1 per cent. There were 6 normoblasts 2 megakaryoblasts. The red blood corpuscles show poikilocytosis, anisocytosis, and polychromatophilia. The platelets were extremely scarce. A blood transfusion of 600 ccm was given the same day. The following day the patient was able to eat a hearty meal. Edema began to disappear and her general condition improved rapidly. On the day following the transfusion the red count was 1,350,000 white count 6,000 hemoglobin 35 per cent. One week later it was noticed that the hemoglobin and red count were beginning to fall, so on January 24 another 600 ccm. of blood was given to the patient. The same evening the red blood count was 1,900,000 hemoglobin 60 per cent. One week later hemoglobin was 50 per cent red count 1,420,000, and white count 3,200. February 10, another week later, hemoglobin 50 per cent red 960,000, whites 6,700. On this date another 550 ccm. of blood was given, on February 17 another 500 ccm. Three days later, hemoglobin 65 per cent, reds 2,310,000 whites 4,450.

On this date a laparotomy was performed. On opening the abdomen considerable free fluid was found the liver was considerably enlarged gall bladder enlarged and filled with black, sandy bile, pancreas was apparently normal, spleen was markedly enlarged and appendix was bound down by adhesions. The operation consisted in removing the appendix and draining the gall bladder. On February 24 the hemoglobin was 50 per cent reds 1,840,000 and whites 4,750. The patient's general condition remained about the same for four weeks

when the blood began to drop rapidly, March 21, 600 ccm. of blood was given and two days later the hemoglobin was 60 per cent reds 2,060,000 and whites 4,000. On March 28 a splenectomy was made and 500 ccm. of blood was given to the patient at the close of the operation. The spleen measured 18 cm x 13 cm x 8 cm.

Spleen cut with ordinary resistance and was rather firm to pressure.

March 28, 1914 splenectomy and transfusion 500 ccm. blood. This was the last transfusion, making six in all.

April 2, 1914, blood showed hemoglobin 55 per cent, reds 2,480,000, whites 10,000.

April 7, 1914, blood showed hemoglobin 55 per cent, reds 2,630,000, whites 17,000.

April 12, 1914, blood showed hemoglobin 55 per cent, reds 2,740,000, whites 17,300.

April 17, 1914, hemoglobin 55 per cent, reds 2,770,000, whites 20,000.

April 23, 1914 discharged. Hemoglobin 55 per cent, reds 2,820,000, whites 21,400.

Differential blood count polymorphonuclears 55 per cent, large lymphocytes 10.5 per cent, small lymphocytes 16.5 per cent. Transitionals 3 per cent, eosinophiles 4.5 per cent myelocyte 1.5 per cent, total 100 per cent.

February 10, 1915 patient returned for observation. Weight 186 pounds. Blood count hemoglobin 90 per cent reds 5,200,000, whites 8,800.

Differential leucocytes 100 small mononuclears 13, large mononuclears 11, Transitionals, 3, polymorphonuclears 73. No abnormal cells of any sort.

The writer has performed multiple massive blood transfusion and splenectomy in five other cases of pernicious anemia, all of which have done equally as well as this case, but wishes to observe them further before making final report.

ADVANTAGES OF METHOD

1 Known quantities of blood may be administered.

2 As much as 600 ccm. can be given in five to eight minutes.

3 Venous blood is utilized, so that arteries, such as the radial, are not destroyed.

4 Transfusion may be made without contaminating donor with blood of recipient.

5 No air comes in contact with the blood.

6 There is direct communication between vein and chamber by a simple paraffin lined glass tube. There are no metal, rubber or other connections whose edges cause resistance to the flow of blood.

7 The apparatus is simple and can be made by any good glass blower.

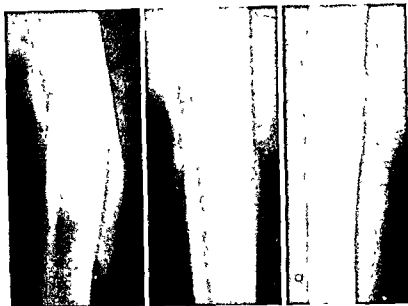


Fig 1

Fig 2

Fig 3

Fig 1 Case 1 Rontgenogram of spiral fracture of the shaft of the humerus

Fig 2 Case 1 Rontgenogram of humerus two months after operation, showing the transplant grafted

to the fragments and bony union between the fragments

Fig 3 Case 1 Rontgenogram of humerus fourteen months after operation, showing partial absorption of the transplant especially at the lower end

the transplant and its host. The graft becomes a living, integral portion of the repaired bone, taking its part in the functional support of the extremity.

II. A peg of living bone is inserted across the line of fracture, through the cancellous bone and anchored to the compact cortical bone at either end, when the interior is composed of spongy, cancellous bone instead of a medullary cavity.

The peg maintains the reduction, lives, and grafts to the surrounding bone under the same conditions required by the transplant when in the medullary canal. The ends of the peg graft directly to the compact cortical bone at the points of contact. That part of the peg which is buried in cancellous bone stimulates the production of osteoblasts and the growth of new bone which spreads from the transplant and infiltrates the spongy bone around the peg until they merge in a continuous bony mass across the line of fracture. This new-bone increases in solidity and strength according to the functional demands put upon it, taking its part in the sup-

port of the extremity, later to be modified and absorbed as the necessity of support lessens.

THE FATE OF THE MEDULLARY TRANSPLANT¹

Occasional early absorption. Absorption of the transplant soon after transplantation occasionally occurs. In such a delicate process as the transplantation of living tissue, absorption may be dependent upon many factors, i.e., the employment of protoplasmic poisons, during the operation, as bichloride of mercury, etc. However, a small percentage of absorptions are due to formation of specific ferments against the foreign tissue protein, which promotes rapid autolysis and absorption.

Early changes in the tissues between the host and the transplant. Any space between the transplant and the bone of the host is immediately filled in with coagulated blood and lymph which undergoes organization into osteoid material. At the same time small capillaries are seen to push through this new-

¹From the laboratory of Clinical Pathology of University Hospital.

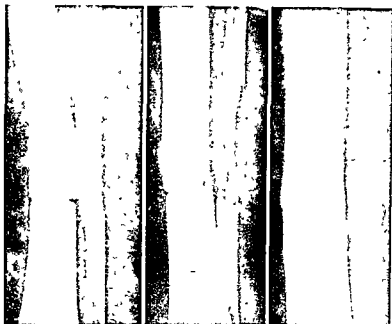


Fig 4

Fig 5

Fig 6

Fig 4 Case 2 Fracture of tibia and fibula

Fig 5 Case 2 Rontgenogram of tibia and fibula two months after operation, showing the fibular transplant in the tibia grafted to the fragments and beginning regeneration of bone at the defect in the fibula

Fig 6 Case 2 Rontgenogram of tibia and fibula seven months after operation showing complete bony repair of the fracture in the tibia with beginning absorption of the transplant and solid bony regeneration at the defect in the fibula

formed tissue from the compact bone of the host to the compact bone of the transplant forming a vascular network about the transplant. Later fine capillaries from this network around the transplant are seen to push themselves into the empty haversian canals of the graft. Both ends of the transplant are sealed off from the distal and proximal marrow cavities by a clot. The surface of these clots at the ends of the transplant are covered over with a layer of endosteal cells from the proliferation of the endosteum of the host.

The surface of the clot is concave, the edges extending up the sides of the bone of the host. The end clots are finally transformed into osteoid tissue and later become calcified. In the case of a fibula transplant, the osteoid material forms a plug extending into the medullary cavity of the transplant. The transplant first becomes firmly fixed at its ends in about thirty days.

Death of the bone cells Many bone-cells in the periphery of the graft retain their vitality, but of those situated in the center of the transplant, only a few are capable of keeping intact the calcium saturated matrix. When a bone-cell dies the matrix under its influence must be removed and new bone laid down in its place. In the transplant bone-cells are seen in all stages of destruction and development.

Reestablishment of a permanent circulation Newly formed capillaries are seen entering the haversian canals of the transplant. They are derived from the fine capillary network formed about the graft. These fine capillaries do not always pass through the graft by way of the haversian canals but are seen passing into the transplant wherever it is possible to gain an entrance. In a fibula-transplant the capillaries pass through the compact bone and ramify in the marrow substance which has been transplanted with the



Fig. 7. Case 3. Röntgenogram of fracture of anatomical neck of humerus.

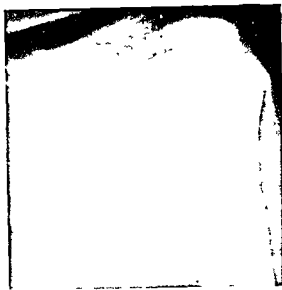


Fig. 8. Case 3. Röntgenogram of head of the humerus five weeks after operation showing the transplant grafted to the fragments and union of the fracture.

fibula. Numerous large cells constantly accompany the blood vessels and are maturing bone-cells. The reestablishment of the permanent circulation is absolutely necessary for the future success of the transplant.

Methods of new bone formation. Necrotic bone may be replaced by the familiar method of lacunar absorption followed by deposition of bone, layer after layer of bone may be replaced by direct continuity. The mature bone cell has either the property of producing bone absorption or the ability to build new bone.

The entire transplant is changed into a complete osseous entity. After many months the transplant becomes directly continuous with the adjacent tissues of the host. The organized tissue undergoes a trabecular stage of bone formation and finally the space it occupies is filled by compact bone. The time necessary for such a complete transformation varies with the size of the graft, the condition and age of the host, and will vary from one to two years.

Final absorption of the transplant. A medullary transplant is not a permanent entity, since a decrease in functional demand is always associated with atrophy and absorp-

tion. As the permanent callus fills the functional demand, the absorption of the osseous splint increases until eventually the transplant is completely absorbed. Total absorption of the transplant placed into the medullary cavity of the humerus will be accomplished in two to five years depending upon its size, the functional result and the age of the patient.

The fate of the transplant placed into cancellous bone. The changes in the compact bone of the transplant are the same as those in any other osseous transplant. However, the changes in the cancellous bone, immediately adjacent to the graft are important. New trabeculae of bone are formed which are directly continuous with the compact bone of the transplant. The new trabeculae extend out between the trabeculae of the cancellous tissue finally producing a more compact osseous structure. Where the area of cancellous tissue between the compact bone of the transplant and the compact bone of the host is small as in experimental animals (head of humerus in a rabbit) the entire area becomes transformed into compact bone. However, this structure is not permanent since there is no physiological function which demands



Fig. 9 Case 4. Röntgenogram of comminuted fracture of anatomical neck and tuberosities of the humerus



Fig. 11 Case 4. Röntgenogram of head of humerus fourteen months after operation, showing extensive absorption of the deposit of new bone and beginning absorption of the transplant



Fig. 10 Case 4. Röntgenogram of head of humerus, eight months after operation showing bony union of the fracture and the transplant grafted in position across the fracture with deposit of new bone around it

compact osseous tissue in this region. With a favorable functional result the recently produced compact bone together with the transplant will eventually undergo absorption since a decrease in functional demand is associated with a corresponding atrophy (disuse atrophy) and absorption.

EXHIBITION OF PATIENTS WITH SERIAL RÖNTGENOGRAMS

CASE 1. Fracture of shaft of humerus. O. S., American clerk, age 37, was admitted to Cook County Hospital after injury to arm caused by falling from a porch while intoxicated. Examination showed a healthy appearing man with slight physical development and with an injury to his left arm accompanied by abnormal mobility, angular deformity, and shortening. Röntgenoscopy revealed a spiral fracture of the shaft of the humerus with slight comminution. The spiral defect was 7 cm. long and the fragments overlapped 3 cm. Reduction and immobilization by external means was not successful (Fig. 1).

Operation for the autoplasmic splinting of the fragment was done February 10, 1914. A transplant was taken from the crest of the tibia 13 cm. long and 12 mm. thick in each direction. It was inserted into the medullary canal of the humerus across the defect caused by the fracture, each end projecting into the corresponding fragment about

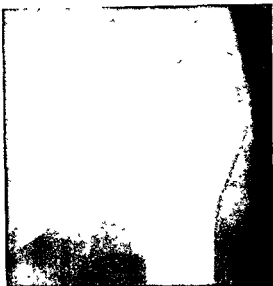


Fig 12 Case 5 Röntgenogram of fracture of the neck of the femur



Fig 13 Case 5 Röntgenogram of neck of femur four months after operation, showing bony union of the fracture and grafting of fibular transplant across the line of union

25 mm., to give support and stability to the repair. The wound was closed by layer sutures, covered with abundant sterile dressings, and the extremity carefully immobilized to the body by plaster of Paris to prevent change in alignment.

Bony union with a palpable callus, a perfect bone line, and a functional arm was present at the end of four weeks. The arm was protected two weeks longer. A röntgenogram taken two months after operation shows bony repair of the fracture with slight external callus, and the transplant grafted to the fragment across the line of fracture (Fig 2). A röntgenogram taken fourteen months after operation shows partial absorption of the transplant. The lower portion of the graft has undergone much more absorption than the upper part, opposite the comminution of the fracture where the functional demands for support were greater and lasted longer (Fig 3). Good anatomical and functional recovery resulted.

CASE 2 Fracture of tibia and fibula. I. M., Irish, school boy age 14, was admitted to the University Hospital September 21, 1914, with his left leg in a plaster cast. He was injured in a run away by collision with a telegraph pole three weeks previous to admission and was taken to Cook County Hospital, where three unsuccessful efforts at reduction, under ether anesthesia, were made.

Examination showed a healthy, vigorous boy, with his left leg in a cast. Röntgenoscopy revealed fractures of both bones in the lower third of the leg, with the fragments out of alignment (Fig 4).

Operation for reduction and autoplasmic bone splinting of the fragments of the tibia was done two days later. The fracture in the tibia was exposed by direct incision and the position and con-

dition of the fragments examined. Another incision on the outside of the leg exposed the fracture in the fibula. A section of the upper fragment of the fibula 6 cm. in length was removed without the periosteum for a bone splint.

The oval shape of the fibula at this section corresponded very closely to the shape and size of the medullary canal of the tibia and, when fitted and introduced as a splint, locked the fragments of the tibia together in a very firm and substantial manner. The wound was closed by layer sutures and covered by a gauze and plaster dressing.

A röntgenogram taken two months after the operation shows good alignment of the fragments of the tibia, grafting of the transplant across the line of fracture, and beginning regeneration of bone at the defect in the fibula. The ends of the medullary canal in the transplant are sealed by new bone (Fig 5). A röntgenogram taken seven months after operation shows complete repair at the line of fracture in the tibia, with beginning absorption of the transplant, especially at the lower end, and reestablishment of the medullary canal of the tibia through that of the transplant. Regeneration at the defect in the fibula exhibits a solid bony replacement in which a new medullary canal is beginning to appear where previous röntgenograms showed earliest efforts at regeneration (Fig 6).

Good anatomical and functional recovery resulted.

CASE 3 Fracture of the anatomical neck of the humerus. J. B., American teamster, age 42, was admitted to Cook County Hospital, one day after he was struck by an automobile. Examination



Fig. 14. Osseous transplant into the cancellous structure of the femur of man. Twenty-three days after transplantation. New formed bony trabeculae continuous with the transplant.

showed a man with the symptoms of fractures of the upper end of the left humerus. Röntgenoscopy revealed a fracture through the anatomical neck of the humerus (Fig. 7).

Operation for autoplasmic repair of the fracture was done ten days later. Incision over the fracture showed that the small fragment was rotated so that the surfaces of the fracture were not in apposition in any part. A canal was made in the cancellous bone in the upper fragment for the reception of one end of the autoplasmic peg and a notch was cut on the medullary wall of the compact bone of the lower fragment to hold the lower end of the peg.

A peg without its periosteum was taken from the spine of the tibia by caliper measurements to fit the space prepared for it in the fragments. The peg was driven into the canal in the small fragment and the other end adjusted in the notch in the lower fragment. While the wound was open and the repair in full view, the forearm and elbow were fastened to the trunk by strips of adhesive plaster to retain by immobilization the position of rotation of the fragments. The wound was closed by catgut sutures in layers, dressed with sterile gauze, and the extremity secured to the trunk by plaster of Paris for four weeks. Röntgenogram five weeks after operation shows good position of the fragments with bony union and transplant grafted to the surrounding bone (Fig. 8).

The patient recovered with full functional use of the shoulder joint.

CASE 4. Fracture of the anatomical neck of the humerus with comminution of the tuberosities. J. I. Irish marine cook, age 49, was admitted to

Cook County Hospital March 3, 1914, suffering from an injury to the left shoulder produced by falling down a stairway while intoxicated.

Examination showed an elderly dissipated man with left shoulder severely bruised, with pain and crepitus on manipulation of the shoulder. Röntgenoscopy showed a fracture of the anatomical neck of the humerus with comminution of the tuberosities and outward displacement of the head of the humerus (Fig. 9).

Open operation was done five days later. Incision over the injury showed the tuberosities crushed and shivered into many small pieces and widely separated. The head was displaced outward and the joint was open.

An autoplasmic bone peg 3 cm. long and 15 mm. thick and 1 wide without its periosteum taken from the crest of the tibia was embedded in the cancellous bone underneath the cartilage of the head of the humerus and the other end of the peg secured in the medullary canal of the lower fragment, the peg holding the head of the humerus like the handle of an umbrella. The fragments that remained attached to the periosteum or cartilage were placed around the peg, the wound closed, and arm immobilized to the trunk in a plaster dressing.

Three weeks after operation the dressings were removed and union appeared to be firm. Manipulation of the arm showed that the head and shaft of the humerus moved together during rotation and other movements of the arm. He left the hospital in another week with good use of arm and shoulder.

A röntgenogram taken eight months after the autoplasmic fixation shows the head of the humerus in position in the glenoid cavity, bony union of the fracture, considerable ragged callus not encroaching upon the joint, the autoplasmic peg intact in position across the healed line of fracture, grafted into the bone and forming an integral part of it with its edges blending into the recipient bone in every direction. The cancellous tissue of the head of the humerus appears infiltrated with new bone of the same type as the transplant from which it was generated (Fig. 10). A röntgenogram taken fourteen months after operation shows extensive absorption of the new bone formation in the head of the humerus and beginning absorption of the transplant (Fig. 11).

A very mobile shoulder joint resulted.

CASE 5. Fracture of the neck of the femur. A. D. Irish laborer, age 64, alcoholic, slipped on the ice and injured his left hip. He was admitted to Cook County Hospital at once, February 2, 1915.

Examination showed in old man with a painful hip, a helpless lower extremity in abduction and eversion of the foot. There was 4 cm. shortening on the injured side. Röntgenoscopy showed a fracture of the neck of the left femur (Fig. 12).

Operation for autoplasmic repair of the fracture was done four days later under ether oxygen anesthesia. The patient was secured to a Hawley fracture table with both thighs strongly abducted and with



Fig. 15 Medullary transplant into the femur of a rabbit six months and two weeks after transplantation. Complete metamorphosis of transplant into an osseous entity showing haversian canals entirely surrounded by lamellae of osseous deposition.

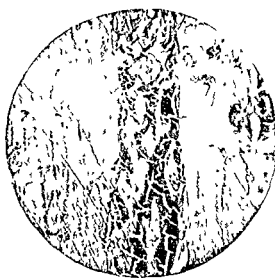


Fig. 16 Medullary transplant into the femur of a rabbit seven weeks after transplantation. Osseous trabeculae filling in the space between the transplant and the cortical bone of the host. Transplant on the left, cortical bone on the right, osseous trabeculae in the center.

slight traction. An incision was made over the greater trochanter and extended downward along the shaft of the femur a sufficient distance to obtain access to the field of the fracture. The line of fracture was exposed by lateral dissection and retraction of the soft parts. The table with the extremity fixed to it was adjusted until reduction of the fragments was complete. A point on the shaft of the femur below the greater trochanter which would give the proper angle for insertion of the peg was selected and a canal was cut with a reamer upward and inward across the line of fracture through the cancellous structure of the neck into the head of the bone.

An autoplasmic peg was taken from the lower part of the fibula of the same extremity. A segment of the whole thickness of the bone without periosteum 11 cm. long was used. The opening in the shaft of the femur was accurately fitted to the irregularities of the larger end, so that the femur would not split when the transplant was driven through or the peg rotate when in position. The peg with the small end first was driven snugly into the canal. The abducted thigh was placed in extreme external rotation to relax the muscles attached to the great trochanter.

The wounds were closed with layer catgut sutures and dressed with sterile gauze. The hip joint was immobilized by a body plaster of Paris cast extending to the axilla to the toes on the injured extremity and including the opposite thigh.

A roentgenogram four months after operation shows bony union of fracture with abundant callus (Fig. 13).

In the autoplasmic treatment of fractures of the neck of the femur three points are of importance:

- 1 Use of a section of fibula for transplant.
- 2 Introduction of the transplant at a high angle to limit cross breaking strain, when possible an angle with the shaft of the femur of 135 degrees.
- 3 Complete immobilization in a position to neutralize muscular action.

CONCLUSIONS

- 1 Autoplasmic treatment of recent simple fractures is indicated where non-operative methods are inefficient.
- 2 The transplant, in the medullary canal in recent fractures of the shaft of long bones, supports the line of fracture, lives and grafts to the compact bone of the fragments.
- 3 The transplant in cancellous tissue, when supported by contact to compact bone, grafts to the compact bone and infiltrates the spongy bone with new-bone, supporting the line of fracture.
- 4 The transplant eventually undergoes modification and absorption as functional demand for support at line of fracture ceases.

DEPARTMENT OF TECHNIQUE

THE EFFICIENCY OF THE COOLIDGE X-RAY TUBE AND THE RATIONALE OF RADIO THERAPY IN THE TREATMENT OF MALIGNANT TUMORS¹

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PHYSICAL PROPERTIES OF ACTINIC RAYS

IT is indispensable to have at least a rudimentary knowledge of the physical properties of the actinic rays in order to understand the requirements for a correct biological and consequently therapeutic utilization of these rays. Actinic rays, i.e., rays emitted by a röntgen tube or by radio active substances, are in many respects analogous to the rays of light. They move in straight lines, they traverse space without any obvious transference or intervention of matter, they act on a photographic plate, excite certain materials to phosphorescence, and bring about the ionization of gas. The only characteristic of light which actinic rays do not possess is the deflection by prisms or lenses. But very recent investigations have shown that such a deflection may be obtained when crystals are used instead of mirrors or prisms. If a pencil of röntgen rays is made to traverse a crystal, diffracted pencils are formed, arranged about the primary beam in a regular pattern, according to the structure of the crystal. A photographic plate placed perpendicular to the primary rays and behind the crystal would show a strong central spot where the primary rays struck it, and other spots arranged in regular fashion around the central spot in the places struck by the diffracted pencils (Figure 15, from *X rays and Crystal Structure* [1] shows such photographs).

Thus it seems quite reasonable to suppose that the rays of light and the actinic rays are qualitatively identical. The difference between the two kinds of rays consists in the fact that the waves of ether forming the actinic rays are considerably shorter than the shortest ultraviolet waves of light. The waves of the so-called soft röntgen rays are about one thousand times shorter than those of ultraviolet light, and the waves of the hard röntgen rays are still shorter. The truth

of this assumption is further enhanced by the fact that the photographs shown in Fig. 15 were calculated mathematically before they were proved by experiment.

All substances, when exposed to a beam of röntgen rays, absorb a part of the rays. The fraction of the rays thus absorbed depends upon the density and thickness and the atomic weight of the substance. The remaining rays penetrate beyond the interposed substance. Besides this, the primary röntgen rays produce in the substance the formation of secondary cathode rays, i.e., swiftly moving electrons and also secondary röntgen rays. Figure 16 gives a rough symbolic sketch of the production of secondary cathode and X rays in matter exposed to primary X rays. In accordance with the modern conception of the structure of matter an atom consists of a large nucleus charged with positive electricity, surrounded like a planet by satellites, by two circles of negatively charged electrons. An electron is the smallest unit of matter known today and is at the same time apparently an independent unit of electricity, in other words it is something which links together matter and energy. The minute spaces between the atoms contain the hypothetical ether, which is supposed to penetrate all space in nature. When a wave of ether is short enough to penetrate between the atoms (i.e. hard röntgen rays) it sets in rapid motion a certain number of electrons and thus creates secondary cathode rays. The rapidly moving electrons on the other hand create new waves in ether situated between the atoms, i.e., create secondary röntgen rays. Very recently Rutherford showed that the P rays emitted by radium may be regarded as secondary röntgen rays produced in the radium by the action of β particles, i.e., electrons. Figure 16 shows graphically the relationship in space between the cathode rays or electrons of the cathode

¹Read at the meeting of the Surgical Section of the New York Academy of Medicine, May, 1911.



Fig. 1 A case of *ulcus rodens* treated by radium



Fig. 2 Radiograph of the chest of Case 3. Left clavicle shows destruction of bone due to a metastasis of carcinoma

of an X ray tube, the primary X-rays, the positively charged nucleus of an atom, the two circles of electrons surrounding the atom of matter, the free electrons between the atoms, i.e., the secondary cathode rays, and the secondary X-rays. The characteristics of the secondary roentgen rays depend solely upon the velocity of the primary cathode rays and the atomic structure of the substance exposed to the primary roentgen rays. The character of the secondary X-rays will be the same, for instance, whether the primary X-rays penetrate a certain metal or a solution of a salt of the same metal. This conception of the structure of matter and the nature of the actinic rays makes clear the importance of the three main characteristics of the rays, namely, the *penetration*, the *absorption* and the *selective action*. Hardest X- or γ rays, i.e., shortest waves of ether, penetrate between the atoms of matter without affecting the substance in any manner. Soft rays, i.e., longer waves of ether, are unable to penetrate between the atoms of the substance and are dispersed over the surface of the substance and again produce no effect on the latter. Only when the relationship between the atomic structure of the substance and the wave length of the X rays is correct does there take place a *selective absorption* of the rays by the substance, and the latter is then influenced by the rays.

THE RELATIVE EFFICIENCY OF THE BIOLOGICAL ACTION OF THE RONTGEN RAYS EMITTED BY THE COOLIDGE AND THE OLD TYPE TUBES

When a plant or animal body is exposed to the action of roentgen or γ rays there undoubtedly take place the same atomic disturbances in the cells of the body as in a piece of metal or any other unorganized substance. As a consequence the rays injure the protoplasm, or more frequently the nuclei of the cells. This biological action differs quantitatively in accordance with the amount and character of the rays absorbed by the cells and the specific susceptibility of the latter to the action of the rays. When slightly injured the cell may completely recover, while if the injury is severe the cell dies. All the tissues of the organism may be killed by a sufficiently large quantity of rays. Nevertheless the biological action of the roentgen rays must be considered *selective*, inasmuch as quantities of the rays sufficient to kill a certain kind of tissue may leave adjacent tissues intact or only slightly injured. In order to obtain this selective action the rays must be distributed as evenly as possible through the organism, so that only a comparatively small



Fig. 3. Microscopic specimen of epitheloma of the vagina before radiation.

quantity of the rays will reach each individual cell. On the other hand, a sufficiently large fraction of the rays must reach as far as possible from the surface of the body. Such a distribu-



Fig. 5. Gross specimen of carcinoma of the sigmoid. The lower part of the photograph shows the tumor covered with the fibrous mass and the skin above it. Its upper part shows the colostomy opening of the sigmoid.



Fig. 4. Microscopic specimen of the vagina after radiation. Connective tissue and round-cell infiltration. No evidence of carcinoma.

tion is possible only with the hard rays, whose penetration is much greater than their absorption.

At present there does not exist a direct method for measuring the quantity and the penetration of the rays necessary to produce a certain biological effect. All the measurements are indirect and are based on the fact that the various chemical actions of the rays are also in direct ratio to their quantity. A solution of barium platinum cyanide, which has normally a green color, becomes brown under the influence of the rays, and the shade depends upon the quantity of the rays used. A strip of photographic film wrapped in black paper and consequently impermeable to the rays of light will become darkened under the influence of the roentgen rays. The shade of



Fig. 6. Gross specimen of a loop of small intestines studded with minute metastatic nodules.

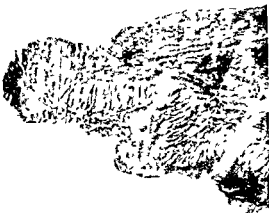


Fig 7 A microscopical section through the sigmoid tumor. Shows, beginning from the top of the photo, rough skin, dense connective tissue, musculature and carcinoma replacing the mucous membrane. (Low power.)

darkening of the strip depends on the quantity of rays used. On the basis of these color reactions, various apparatus are devised for measuring the quantities of the roentgen rays emitted by a tube in a unit of time.

Before reporting the results of the present experimental study on the relative therapeutic efficiency of the Coolidge and old-type X-ray tubes, a brief outline must be given of the differences in the physical characteristics of the two types of tubes.

Röntgen rays originate on the surface of a metal which is bombarded by the negative electrons of the cathode rays. The greater the velocity of the cathode rays the harder, the more penetrating, are the roentgen rays. The tubes of the old type have an incomplete vacuum. A high potential current passes in the tube from the anode to the cathode, frees the electrons of the latter, and propels them toward the anticathode or target. The bombarding of the electrons induces the formation of the roentgen rays on the surface of the target. The target is built of a heavy metal and becomes overheated under the action of the cathode rays. The heat frees the gases contained in the metal of the target, and these in turn diminish the vacuum of the tube. As a consequence the velocity of the cathode rays also diminishes and the roentgen rays become softer. Various regulating devices are added to the tube in order to keep the character of the roentgen rays uniformly hard for the length of time necessary for therapeutic purposes. Still the penetration of the rays emitted by the



Fig 8 Microscopic section of the connective tissue surrounding the sigmoid tumor. There are scattered islands of degenerated carcinoma cells (the black dots).

tube constantly changes. The old type tube used in the present study is the one devised by Gauss (2), of Freiburg, for therapy. It has a water cooling chamber to diminish the heating of the target, a large auxiliary vacuum bulb to diminish the influence of the gases freed from the overheated target on the combined vacuum, and a gas regulator to increase the amount of gas in the bulbs and diminish the vacuum when it becomes too high, and consequently no X-rays can be formed. This Gauss tube is by far superior to any other of the ordinary old type gas tubes. Therefore, as will be shown later, the difference between the Gauss and Coolidge tubes found in the present study, though very marked, is not as great as the one found by L. G. Cole (3) in his experiments.

The fundamental advantage of the Coolidge tube consists in the fact that it has nearly a complete vacuum, so that the small amount of gas escaping from a heated target cannot influence it. Moreover, the target is built of tungsten,

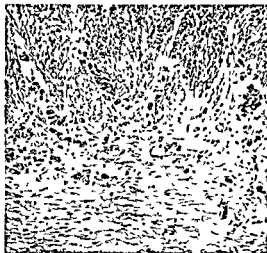


Fig 9 A microscopic section of a peritoneal metastatic nodule of carcinoma. The upper part of the photograph shows musculature of the intestinal wall, the lower, dense connective tissue. The islands of black spots represent tumor islands.

which is completely freed of gas before the tube is built. In such a tube with a very complete vacuum a high potential current cannot pass from the anode to the cathode and free the negative electrons of the latter. The freeing of the cathode rays is accomplished in the Coolidge tube through the heating of the cathode to a very high temperature by the aid of a special storage battery. The cathode consists of a spiral tungsten filament supported by a molybdenum sleeve. The high potential current propels the electrons to the anode, which acts at the same time as a target. The number of the electrons depends upon the temperature of the filament of the cathode and their velocity on the voltage of the primary current. Figure 17 shows the diagrams of the two tubes used.

A priori it could be expected that the Coolidge tube would not only produce a greater output of roentgen rays, but also would generate rays of greater uniformity of penetration. Comparative experiments were done, as was stated above, with the Gauss and the Coolidge tubes, using a very heavy German coil as a generator. Both tubes were placed approximately under similar conditions, i.e., the same voltage of primary current was sent through the coil, nearly the same number of milliamperes of high potential current were sent through the tube, and the resulting roentgen rays showed the same penetrating power.

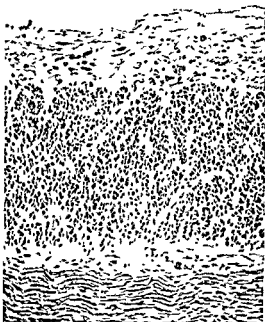


Fig 10 A microscopic section of the wall of the small intestines. The upper margin of the photograph shows normal peritoneal endothelium unaffected by the radiation.

To study the distribution of the rays, pieces of meat of certain thickness and also living animals (pigeons) were radiated. Test strips of photographic paper (Kienbock strips) were placed on the surface of the radiated piece and at various depths of tissue. Pieces of meat were used 1, 1.5, 2, 3, and 4 inches in thickness. The very soft rays, which usually act only on the surface of the skin of the animal and are not selective but caustic in their action, were absorbed by a plate of aluminum 3 mm in thickness and a layer of chamois leather 2 mm thick placed between the tube and the tissue. This filtration was selected as being identical with the filtration used by the writer in his clinical work. The pigeons were placed in a box 4 inches deep. One Kienbock strip was placed over the box and the other under the box. Figure 18 shows the records of two experiments: *a*, an experiment with 4 inches of meat and a Gauss tube, *b*, an experiment with 4 inches of meat and a Coolidge tube, *c* shows the Kienbock quantimeter and the method of estimation.

The results of numerous experiments may be summarized as follows:

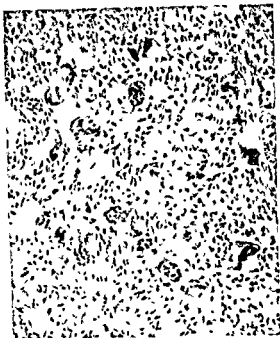


Fig 11 Microscopic section from tumor of Case 8 before treatment Shows sarcoma with numerous giant cells



Fig 12 Microscopic section from tumor of Case 8 after treatment Shows connective tissue, no tumor cells

To obtain the same quantity of rays on the surface with a Coolidge tube takes about one-third of the time that was required with the old-type tubes. At the depth of 2 inches of meat the strip shows about one-third the quantity of the rays shown by the surface strip during the same experiment with an old-type tube and about one-half by the Coolidge tube. At a depth of 4 inches there is usually about one-seventh of the quantity shown on the surface obtained from a Gauss type, while from a Coolidge tube one obtains at the same depth usually one-fifth of the quantity shown on the surface. There is no complete regularity in the results of the experiments with either tube, but the Coolidge tube shows a far greater uniformity. The reason for this superiority shown by the Coolidge tube is probably due to the following. The roentgen rays emitted by a tube are never uniform in their character and represent all grades of hardness. The methods of measuring the penetration of the tube reveal only the hardest rays. Apparently the rays are more uniform in the Coolidge tube and a greater proportion of the pencil of rays are of the hardest quality, and therefore a higher fraction of those entering the surface reach a certain depth. Another great advantage of the

Coolidge tube consists in the fact that when it is once regulated to a certain penetration it remains so for an indefinite period of time. On the other hand, it must not be presumed that the rays of the Coolidge tube have an unlimited capacity of absolute penetration. As stated above, the velocity of the cathode rays and the consequent penetration of the roentgen rays is in direct proportion to the intensity of the high potential current. The latter cannot be increased beyond a certain limit in the Coolidge tube as it is constructed today. But, as stated above, the most recent investigations on the nature of the secondary roentgen rays, as well as the constant improvements in the construction of the generating machines and tubes, leave no doubt that the near future will show a great deal of further progress in the efficiency of the therapeutic action of the roentgen rays.

RESULTS OF THE TREATMENT OF MALIGNANT TUMORS BY RADIUM AND RÖNTGEN RAYS

As stated above, the susceptibility to the action of the actinic rays varies in degree with the cells of the different tissues. The cells of malignant tumors are more susceptible to the action

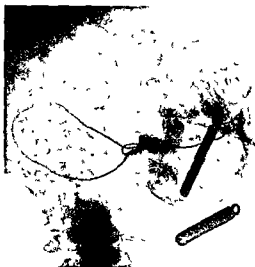


Fig. 13 Radiograph of Case 8 before treatment. Shows tumor of the lower jaw, with two radium tubes in situ.

of the rays than the cells of normal tissues surrounding the tumor. If the rays employed are of a correct quality and in a sufficient quantity it is possible to destroy all the cancer cells in a certain locality and at the same time leave the normal tissues either intact or so slightly injured that they ultimately completely recover.

The best proof of this assertion can be seen in the results of the treatment of ulcers of the nose. The writer treated several cases in which the ulcer was smaller than the tube of radium employed. Figure 1 shows the result of treatment of such a case of ulcers of the nose. Only a part of the tube covered the ulcer, the rest of the tube lying just as closely to the normal skin. The normal skin was not injured or even irritated in any degree, while the ulcer was healed. This indicates sufficiently well that the radium employed with the modern technique does not act as a simple caustic, but has a selective action on the tumor cells.

This quantitatively selective action of the rays may reach to a depth of at least 3.5 cm. Bumm and Warnke (4) and Vickham and Degrais (5) state that it is even possible, with the modern methods of roentgen or radium therapy, to destroy cancer-tissue at a depth of 9 to 10 cm. The action of the rays on a malignant growth consists primarily in the destruction of the tumor-cells and subsequently the formation of sclerotic connective tissue which compresses and destroys the remaining tumor cells.



Fig. 14 Radiograph of Case 8 after treatment. The arrows show the new bone formation.

It is as yet difficult to obtain a true valuation of the significance of radiotherapy in the treatment of malignant tumors. The modern correct methods have been in use less than three years and the majority of cases in which it is employed are the most advanced forms of the disease. Nevertheless, as will be seen later, some of the results obtained are very significant and promising. Excluding epitheliomata of the skin and cases in which treatment began too recently for a correct analysis the writer treated, during the last eighteen months, 41 cases of deep-seated malignant tumors with the modern methods of radium and roentgen therapy. The conditions were distributed as follows:

Carcinoma of the breast	9
Carcinoma of the mouth	6
Carcinoma of the larynx	1
Carcinoma of the esophagus	3
Carcinoma of the uterus and vagina	7
Carcinoma of the ovary	1
Carcinoma of the urinary bladder	1
Carcinoma of the stomach	4
Carcinoma of the sigmoid and rectum	5
Sarcoma	4

Of these cases, 13 died, 11 discontinued treatment, 14 remained unimproved, and 3 seem to be at present clinically cured. At first glance these results do not seem to be gratifying, the more so that even the clinically cured cases, which represent 7.5 per cent of all cases treated, have not been observed long enough to give any certainty as to the permanency of the results. On the other hand, considering the hopelessness of the class of cases that came under treatment, the results are by far superior to anything which

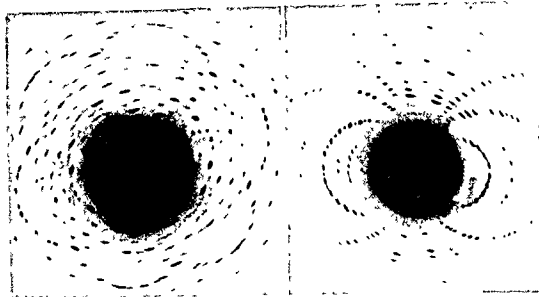


Fig 15 Photographs of a pencil of röntgen rays passed through a crystal, beryl left, nickel sulphate right

was attempted with this class of cases previously. Moreover, in several cases which did not improve clinically under treatment, morphological changes were noted in the tumors which strikingly indicate the value of radiotherapy in the treatment of malignant tumors, when the class of cases, the time, and the method of treatment are selected correctly. The histories of a few selected cases will illustrate these points:

CASE 1 Mrs Br, age 39. A radical amputation of the right breast for carcinoma was done on November 17, 1913. The axillary and the supraclavicular glands were involved and all the malignant tissue could not be removed. The supraclavicular and axillary region were treated with radium and the other regions of the right side of the chest with röntgen rays. In the subsequent course of the disease there developed carcinoma in the other breast and metastases in both femurs and internal organs. The patient died nine months after the operation. The right side of the chest which was radiated, did not show any local recurrence all through these months.

It is frequently noticed, in recurrent carcinoma of the breast treated by the rays, that while the patient may die from the metastases in the internal organs, the chest-walls remain free of the tumor. The psychic effect of the phenomenon upon the patient is very gratifying.

CASE 2 Mrs K, age 36. A radical amputation of the right breast for adenocarcinoma was done on October 4, 1913. Soon after the operation there appeared a recurrence in a supraclavicular lymphatic gland, which appeared to be about $\frac{1}{4}$ inch in diameter.

Dr I. Adler referred the patient to the writer on November 16, 1913. Under radium and röntgen ray treatment the nodule disappeared. The patient disregarded the

advice to continue the treatment. Two months later there developed a nodule about 1 inch long by $\frac{3}{4}$ inch wide by $\frac{1}{2}$ inch thick, adherent to the third rib. The surgeon advised operative removal, which was done. The removal could not have been done completely, and particles of the tumor remained adherent to the rib. The patient died two months later with symptoms of metastasis in the brain.

It seems possible that if the second metastatic nodule had been radiated and no surgical interference had been attempted the rapid dissemination in the brain might not have taken place.

CASE 3 Mrs B, age 54. Had the left breast amputated for carcinoma on April 7, 1911. In the summer of 1914 there developed a swelling measuring 2 inches long, $\frac{1}{4}$ inch wide, and 1 inch high adherent to the left clavicle. The radiograph (Fig 2) shows partial destruction of the bone, and consequently a metastasis in the left clavicle. The case was referred to the writer by the surgeon (Dr Bodenheimer) in August, 1914. Under combined radium and röntgen treatment the swelling practically disappeared. At present, nine months after the beginning of the treatment, the patient is clinically well and there is no indication of a recurrence anywhere.

Though the patient was not observed long enough to be certain of an ultimate cure, it is remarkable that nine months after a metastasis in the bone was noticed there should not have taken place any apparent further dissemination of the carcinoma. The case is further remarkable as the second case on record in which a metastasis in the bone was influenced by radiation. The first case was reported recently by Pfahler (6).

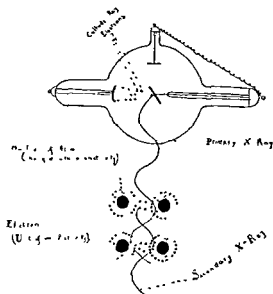


Fig 16 A symbolic drawing of the structure of matter and the action of X rays upon it

CASE 4 Mrs F, age 60 was operated upon in April, 1913, for carcinoma of the vulva. In September another operation was done with removal of inguinal glands on both sides. On November 24, 1913, the patient was referred for treatment by Dr Rongy. There was a flat ulceration in the posterior commissure of the introitus vulval. In four weeks of combined radium and röntgen treatment, the local epithelioma healed. Three months later there appeared large masses of carcinoma in both inguinal regions which did not respond to the treatment, and the patient died in six months. While the treatment failed ultimately, there was a very evident local effect of the treatment.

CASE 5 Miss M, age 23 was operated on August 12, 1914, for a malignant tumor of the ovary (endothelioma). At the operation disseminated tumor masses were found in the peritoneal cavity. The ovary and some of the tumor masses were removed and the incision closed. A recurrence took place in the abdominal wall which was again operated upon. The wound never healed and there developed at the lower end of the incision an ulcer about 2 inches in diameter. The patient was referred to the writer in October 1914. She is still under treatment. Recently there has developed again a tumor mass in the right upper half of the peritoneal cavity, but the ulcer cleared up, and a section made in April list of an excised piece shows granulation tissue and no evidence of tumor cells.

CASE 6 Mrs G, age 50. On April 24, 1913, she was admitted to the German Hospital service of Dr Seeligmann, where a diagnosis was made of primary carcinoma of the vagina. A piece was excised for microscopical examination which showed a squamous-cell epithelioma (Fig 3). The condition was considered to be inoperable, and on February 27, 1914 the patient was referred to the writer by Dr Seeligmann and Dr Kessler.

The patient appeared emaciated, weighed 115 pounds, complained of continuous bloody fecal vaginal discharge,

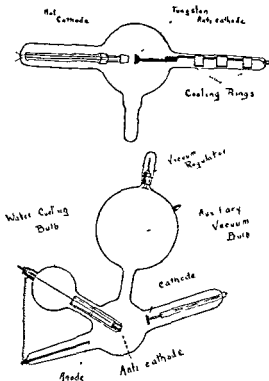


Fig 27 Diagrams of two röntgen ray tubes. The upper is the Cooling tube, the lower the Gauss therapy tube

constant backache, pain on defecation, rectal tenesmus, painful and frequent micturition. She was urinating from five to six times a night. On examination the labia and vulva appeared normal with the exception of the presence of a sanguineous fetid discharge. On separating the vaginal walls there is noticed beginning about 1 3/4 inch from the introitus vaginæ an ulcerated area which circled around the whole vaginal wall, but appeared to be deeper on the posterior side. The margins of the ulcer were indurated and the surface consisted of friable tumor tissue, which was very easily detached. The vaginal canal was so constricted by the ulceration that one finger could hardly pass through. Rectal examination showed that the mucous wall of the rectum was not involved in the growth and the uterus appeared normal. The right uterosacral ligament appeared thickened, infiltrated, and hard.

A combined radium and röntgen treatment was employed. The patient received eight applications of radium of 12 hours' duration each with an interval of 36 hours between the applications. The amount of radium salt used was 50 mg. The tube was screened with 0.5 mm. of silver, 0.75 mm. of gold, and layers of photographic paper to protect against the caustic action of the secondary rays. The whole was enclosed in a sterile rubber tube. At the same time the treatment was supported with massive doses of X rays.

In all ten X ray treatments were given. A Gauss water-cooled tube was used. Penetration showed that 9/15

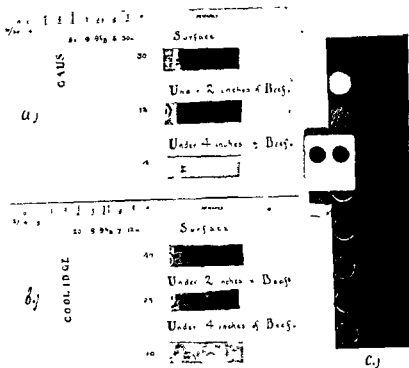


Fig 18 Records of two experiments a, An experiment with 4 inches of meat and a Gauss tube b, An experiment with 4 inches of meat and a Coolidge tube c, The Kienböck quantummeter and the method of estimation

Bauer 455 M A, were sent through the tube. The rays were filtered with 3 mm. of aluminum and 2 mm. of chamois leather. The rays were sent through four fields of the abdomen and through two fields on the back. Their combined quantity equaled 480 X as measured by Kienböck photographic strips. On May 26, 1914 the patient was presented to the Gynecological Section of the Academy of Medicine. Then she had no vaginal discharge, no back aches, no rectal discomfort and no frequency or pain on micturition. She gained 15 pounds and was able to attend to her household duties.

Objectively the vaginal wall presented at a distance of 1 1/2 inches from the introitus vaginae an annular indurated scarlike mass, the cervix was even more contracted than when the treatment began. The surface of it was smooth and not friable. A piece was excised for microscopical examination throughout the whole thickness of the vaginal wall. The piece was taken from the right lateral wall on one hand in order to be nearer the right uterosacral ligament and on the other hand not to injure the bladder or the rectum. A microscopical examination of the piece showed absence of cancer tissue, the latter being replaced by a connective-tissue and round-cell infiltration (Fig 4).

Since then the patient gained 30 pounds more, i. e. 45 pounds since the beginning of treatment and she seems perfectly well.

Though fifteen months is not long enough for a positive prognosis, the chances for complete recovery of the patient are very good.

CASE 7. Mr T, age 29. About the middle of June, 1914 and again on July 1 the patient had an attack of excessive pain in the epigastrium radiating over the whole abdomen, he vomited yellowish fluid and afterward had continuous bloody diarrhea for about 14 hours and only on the third day had the movements without blood.

On admission to the hospital July 1, 1914, the patient looked very sick. The eyelids were half closed, the tongue was dry and somewhat furred, pulse 60, temperature 100.4°, abdomen distended, tympanitic, most tender in right hypochondrium less in left, still less over right iliac. No tenderness over McBurney's point. No evidence of gas or fluid in peritoneal cavity. Rectal examination showed slightly tender cords extending upward from prostate on both sides. No mass palpable, no blood on examining finger. Stools show particles of mucus and suggestion of blood. X ray showed marked obstruction at the transition of descending colon into sigmoid — only a small part of the enema passed beyond obstructed part. The defect at the distal portion of descending colon began at the seat of obstruction and extended proximally for about 3 inches suggestive of a tumor of the colon in the region. Temperature ranged from 98° to 101°. The diagnosis was made of carcinoma of the sigmoid, and on August 27, 1914 an exploratory laparotomy was performed. Two incisions were made, one horizontally on the upper half of the abdomen and another on the right lower quadrant of the abdomen. In the sigmoid was discovered a hard nodular mass the size of a hen's egg, hard in consistency and growing from the inside of the sigmoid. The peritoneum was found to be studded everywhere with small

Surgeon	No of patients treated	Organ	Died	Discontinued treatment	Became worse	Not improved	Improved	Became operable	Clinically cured	Operable cases
Doederlein		Uterus					54		35	
Chevron and Duval	155	Uterus				2	110	12	34	3
Allman	85	Uterus	1				15	40		
Wertheim	102	Uterus	23		8	21	31	19		21
Guisez	35	Esophagus							5	
Werner	314	Various					61			
Pinch	105	Various	11	10		52	65		0	
von Eiselsberg	45	Various	11	18	7	1	5		6	
Schmitz	23	Various				10	3		7	
I. Levin	47	Various	7	11		14			3	
Total	1001							51	57	

peated once a week for 5 weeks. Another tube with 25 mg. of radium was placed outside to the skin of the cheek and kept for 18 hours. Figure 13 was taken immediately after the beginning of the first radium treatment and shows the two tubes *in situ*.

Following the radium treatment röntgen treatment was given by the aid of a Coolidge tube. The skin of the right cheek was divided in six fields each $\frac{1}{2}$ inch in diameter and 30 \ was sent through each field. Four treatments were given through the mouth each of 40 \. So that in all the patient received 340 \.

Eight weeks after the beginning of the treatment a specimen was again removed for microscopic examination from the same region from which the previous was obtained. The section shows a very loose connective tissue relatively poor in cells and beneath this a denser zone of cellular connective tissue. No giant cells or distinct spindle cells are present (Fig. 12). A radiograph taken at the same time shows that the whole tumor is surrounded by a great deal of new bone formation (Fig. 14). An examination through the mouth shows the tumor to have completely disappeared and instead there is present a large cavity lined by a shell of bone.

It is too early to draw any conclusions as to the final outcome of this case, but apparently the tumor-tissue is being replaced by newly-formed connective tissue and bone.

STATISTICAL ANALYSIS OF THE LITERATURE ON RADIOTHERAPY OF MALIGNANT TUMORS

In order to obtain a better estimate of the results reported in the present study the writer deemed it of advantage to compare them with some of the more recent reports of other investigators. The publications of the last two years in which the modern methods of radiotherapy were employed were analyzed.

Of the very extensive literature on the subject only those reports were selected in which the whole number of cases treated in a certain clinic

were given and not the selected favorable cases only. The accompanying chart presents graphically the result of the analysis.

The names in the first column do not always represent the author of the article, but frequently the name of the chief of the clinic, which is occasionally important for the true estimation of the report. Nos. 7, 8, 9, 10, 11, 12, 13, 14, 15 of the bibliography give in rotation the articles analyzed. The report of Doederlein's clinic is given, though the whole number of treated cases is not indicated, in order to show that a man of his clinical experience undertook to treat 35 operable cases with radiotherapy alone. But his cases are not included in the total calculation of the figures.

Chevron and Duval state that a certain number of their cases remain cured after 4 years. They also report that of the 51 cases of carcinoma of the uterus which became operable in many of the subsequently extirpated uteri no carcinoma cells were found. Guisez reports that 2 of the 3 cured cases of carcinoma of the esophagus remain well after 2 years. Von Eiselsberg and his school are very cautious and even pessimistic in their valuation of radiotherapy and still they report 6 clinically cured cases out of a total of 48 inoperable cases, or 12 per cent of the cases treated.

The chart shows a total of 1,002 cases. Of these 57 cases were clinically cured and 51 cases became operable. There are reported in all 58 cases treated by radiation alone which were in an operable stage. Of these 35 cases belong to Doederlein and were not included in the calculation. The 21 cases of Wertheim must be deducted from the sum total of cases treated but not from the clinically cured cases, since Wertheim does not give the number of clinically cured cases. The 2 operable cases of Chevron and Duval must be deducted both from the sum total and the number of clinically cured cases. There remains a total of 979 cases of which 55 are reported clinically cured. Of the 51 cases which became operable at least 25 per cent, or 12 cases, must have also become clinically cured. This gives a total of 67 cases or 6.7 per cent clinically cured. These figures are similar to those reported by the writer, which are shown in the last line of the chart.

RATIONALE OF RADIOTHERAPY

A therapeutic method which is capable of producing a clinical cure in 6.7 per cent of a total of 1,002 inoperable cases of malignant tumor is by far superior in its efficiency as well

as the number treated, to any therapeutic measure which was ever offered for these cases.

But these numerical results do not indicate the true value of this method of treatment. As stated above, the therapeutic action of the actinic rays is not entirely local. The rays may destroy cancer-cells at considerable distance from the source of the rays. But only the hardest rays can reach at that distance. They again represent a small fraction of the whole beam of rays and their action diminishes in the inverse ratio to the square of the distance. Consequently, the further the distance of the tumor from the surface of the body, the smaller its size must be in order to be destroyed by the rays. Minute metastatic nodules can be destroyed by the aid of radiotherapy at a great distance from the surface of the body. This observation, strikingly illustrated in Case 7 of the present report, shows the actual rationale of radiotherapy in the treatment of malignant tumors, its relation to surgical treatment, and the road to the future progress.

It would be out of place to describe here in full the correct methods of radium and roentgen therapy and the proper combination of both, and of radiotherapy with surgery. Some indications of the methods used were given in connection with the Cases 6, 7, and 8. Those interested may find complete description of the technique in previous publications of the writer (16).

Correct radiotherapy implies a thorough understanding of the pathological and clinical condition of the patient as well as of the technique, dangers, and limitations of the therapeutic measure. The great success of radiotherapy in Germany dates from the time when the surgeons and gynecologists themselves undertook this method of treatment instead of referring the patients to the radiographers. The future success of the whole field of treatment of malignant tumors depends upon a very close cooperation between the radiotherapist, surgeon, and pathologist.

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NITROUS OXIDE IN LABOR¹

By N. SPROUNT HEANEY, M.D., CHICAGO

SINCE the introduction of narcotics and anesthetics into general medicine there has been a constant effort to adapt their usage to the alleviation of the pain in labor, but difficulty has been met in securing efficiency of action with safety to mother and child.

The literature dealing with the administration of chloroform, ether, chloral, morphine, and scopolamine, and with the various methods of producing local anesthesia to secure painless labor is familiar to all of us and need not be mentioned in this paper. Neither is it necessary to enter into a discussion of the failures or dangers of these various drugs, since these things also are well known.

Lynch² in a recent paper states that Kikowitch of Petrograd, in 1880 was probably the first to use nitrous oxide gas during labor. He gave a mixture of 80 parts of nitrous oxide and 20 parts of oxygen to a series of 25 cases. As soon as the cervix admitted one or two fingers he began the use of the gas and he continued it intermittently throughout the entire labor. He gave only sufficient to abolish pain but not enough to produce unconsciousness. The contractions were never diminished in intensity but, to the contrary, were often increased. The fetal and maternal pulse were not much altered. Though his results were so gratifying, his method found

¹J. Am. M. Ass. 1915 March 6. *Trans. M. J.*, 1915 April.

²Read at the meeting of the American Gynecological Society, White Sulphur Springs, West Virginia, May 24 to 26, 1915.

no followers Tittel in 1883 and Doederlein in 1886 also wrote of nitrous oxide gas in labor but they undoubtedly administered it to the surgical degree

During the past ten years J. Clarence Webster¹ at the Presbyterian Hospital has been largely substituting nitrous-oxide gas and oxygen for ether in obstetrical work. Versions, forceps, cesarean sections, and various other obstetrical operations are performed under this anæsthetic, when it seems better suited to the condition of the patient than ether. He also early used it for the conduct of normal labor in the second stage, allowing the patient a light degree of anæsthesia during pains, with a return to the normal state between pains.

Lynch, in August, 1913, began to use nitrous-oxide gas and oxygen in labor in the method to be described in this paper, and subsequently I began independently to use it. The various members of the Obstetrical Department at the Presbyterian Hospital have now had a large experience in its administration and each has added some perfection in technique or has otherwise contributed to our general knowledge regarding the subject.

With a proper machine and a nasal inhaler nitrous oxide may be given to the extent that the patient does not experience pain during labor, yet maintains her consciousness and if need be, can follow the directions of the attending physician. If oxygen is administered at the same time this stage of analgesia is more easily maintained and the headaches sometimes complained of after pure nitrous oxide are much more infrequent. How much gas is necessary to bring a patient to the stage of analgesia depends somewhat upon the efficiency of the machine used, but principally, upon the susceptibility of the individual. Some require more and others less. The less nitrous oxide required to produce analgesia, the more oxygen that is necessary. Usually the mixture is such at the beginning of a pain that three to four quick inhalations are sufficient to produce analgesia, while the patient retains her normal color and remains entirely conscious. Each patient differs so that the mixture must vary also. A few pains will establish the mixture necessary in each case. When once analgesic more oxygen may be given, until at the end of a long pain either pure oxygen is given or the nose-piece removed.

If the mixture is too rich, analgesia is imperfect and the patient passes into a deeper stage and may complain of pain, she then begins to become cyanotic, the consciousness becomes clouded,

and, if pushed further, the patient enters the familiar stage of surgical anæsthesia with its attendant phenomena. When giving the gas for the first time the tendency is to give much more than is necessary; the least possible amount usually secures the most satisfactory analgesia. By careful observation the analgesic stage can be maintained for hours. The patient may be directed, as Lynch advises, to keep the eyes open during the administration and to watch a light placed in a convenient location. If it is noted that the light is beginning to appear unnatural, then the patient must breathe through the uncovered mouth. If the operator observes that the lids are beginning to droop or that the lips are beginning to show a suggestion of cyanosis the patient is directed to breathe deeply through the mouth and quickly returns to the analgesic state.

When it is explained to the patient that she is not supposed to sleep but to have full control of her faculties, and that in the event that she feels herself slipping into unconsciousness that she must breathe through the mouth, most women will be able to keep themselves in the desired state of equilibrium. Occasionally one meets, however, an individual who, because she fears that she will have pain will, if left to her own devices, continually pass into too deep a stage. Careful watching of such an individual, with a sharp direction at the proper moment to breathe through the mouth, prevents this undesirable overdosage. No physical harm results from this slight degree of overdosage, except that if the patient is in the second stage, her unconsciousness prevents her from giving the very useful help so characteristic of the proper stage of analgesia. The administration may be begun at any time when the pains begin to be severe. Usually this is left to the inclination of the patient. Rarely does she consider it necessary before dilatation is well advanced, usually it is not asked for until the membranes have ruptured or are ready to be ruptured.

The hand placed upon the abdomen feels the contraction of the uterus before the patient perceives the pain. At this time the nasal inhaler is placed over the patient's nose and she is directed to take the necessary number of inhalations previously determined to be necessary in her case. In the event that she is in the second stage she then holds her breath and bears down or pulls upon the straps provided for this purpose. When this breath is exhausted, if apparently well within the analgesic zone, she breathes again through the nose, some oxygen

being added to the mixture, and bears down again. If it is noted that the patient is getting too much, she breathes through the uncovered mouth and bears down. The usual second stage pain is divided into three or four expulsive efforts. The patient usually knows when the contraction has ceased, because she no longer desires to bear down, at which time the inhaler is removed and the hand is placed upon the abdomen to await the signal for the re-administration of the gas. By questioning the patient between pains, the mixture necessary to obtain the ideal result is quickly determined.

To insure absolute painlessness the gas may be given to the surgical degree during the last few pains, or if, as it frequently happens, the birth begins to advance too rapidly, ether may be mixed with the gas or substituted for it.

In a few cases manual dilatation of the cervix was done under analgesia, the patient entirely conscious yet feeling no pain. In the same way I have on a number of occasions converted a persistent posterior to an anterior presentation, introducing the whole hand into the vagina, the patient though conscious complaining of no pain.

The frequency of the labor pains is not disturbed by nitrous oxide, nor is the duration of the contraction, when the patient is kept in the equilibrium of analgesia. Indeed, during the expulsive stage, the efficiency of the pains is increased, since the patient can use the secondary muscles of expulsion to their utmost capacity without fear.

The fetal heart-tones are not disturbed and the baby cries immediately upon birth, its dose of anesthesia is as evanescent in its action as is the mother's. The mother is always conscious and in full possession of her faculties within a minute or two of the birth.

There is no relaxation of the uterus, and providing that ether has not been used the third stage

terminates as promptly and as satisfactorily as when no anæsthetic is used.

The perineum is usually repaired under analgesia, preceding the birth of the placenta. This generally proceeds without difficulty, though occasionally the stitches near the anus may produce slight pain.

In the same way I have used the gas for the removal of stitches in highly nervous women, and also for the painful procedure of removing a uterine pack.

The amount of gas necessary for the conduct of a case varies greatly with the type of machine used. If no shutoff is attached, the gas remaining in the bag at the end of a pain escapes and much gas is wasted during the course of one administration. A wasteful operator will use much more gas than is necessary. With experience one will find that the amount is also reduced. One of the small cylinders has more than once sufficed for more than three and one-half hours' administration. The cost of the gas may be materially lessened in hospitals by the use of the large cylinders. For outside work an efficient portable apparatus, which with cylinders will fit in a suitcase, is made by several different manufacturers.

Nitrous-oxide and oxygen analgesia may be given just as efficiently in a home as in a hospital. No expert anæsthetist is necessary. With a little instruction a layman may give the gas, the obstetrician carefully controlling the administration. That the physician may remain clean and yet administer the gas himself, Dr. C. H. Davis of our staff has invented a foot attachment, by which the flow of gas is controlled.

From our observations our staff is united in the belief that in nitrous-oxide and oxygen analgesia we have not only an efficient means of controlling the suffering in labor but also a safe means, free of all the well known and valid objections against other means of securing painless labor.

INTESTINAL OBSTRUCTION CONSECUTIVE UPON POSTERIOR RETROCOLIC GASTRO-ENTEROSTOMY

WITH DESCRIPTION OF A METHOD TO AVOID SIMILAR COMPLICATIONS

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THE report of a case is herewith given, illustrating a most unusual complication following upon gastro-enterostomy. The few similar cases, seven in number, which have been reported in the literature, are briefly cited, and an attempt is made to describe the mechanism by which this variety of ileus can and did occur. Finally a method will be indicated where by this complication can be avoided.

Mt. Sinai Hospital, No. 150, 46th St. J. F., an Italian, age 25, was admitted December 1, 1914, to the medical service of Dr. Libman, with the history that for one and one half years previously he had suffered from gastric disturbances. More particularly there had been marked pain and burning in the epigastrium after the ingestion of food, which had always been relieved by vomiting. Of late the vomitus was very profuse in amount and consisted of partly digested food. At no time had there been any vomiting of blood. There was progressive loss of weight, in spite of the fact that the patient had developed a ravenous appetite.

With the exception of a tender area in the epigastrium, to the right of the median line, the physical examination was negative. The examination of the stomach contents after Ewald test breakfasts showed invariably the presence of excessive hyperacidic blood, and retention of food much beyond the normal period. The X-ray studies demonstrated an obstruction at the pylorus with marked dilatation of the stomach.

A diagnosis of duodenal ulcer, causing pyloric obstruction, with secondary dilatation of the stomach was made, and an indication for operative treatment being evident the patient was transferred on December 5 to the surgical service of Dr. Moschcowitz.

Operation December 9, 1914 by Dr. Moschcowitz. A transverse (Sprengel) incision was made through the upper part of the left rectus muscle. The stomach was enormously dilated, and the pylorus and first portion of the duodenum were found to be occupied by a large mass adherent to the surrounding structures. This was diagnosed as a callous ulcer obstructing the lumen of the gut. A short loop posterior retrocolic gastro-enterostomy was made by the suture method, and the pylorus was excluded by plicating the anterior wall of the stomach. At the conclusion of the operation the stoma was parallel with the greater curvature of the stomach, the afferent loop passed from left to right and the efferent loop proceeded toward the right and passed downward in the general direction of the right iliac fossa. The patient reacted well from the operation, and the usual routine treatment employed on the service was instituted.

On the second day after operation contrary to what we are accustomed to see, the patient vomited small quantities of coffee ground material at frequent intervals, and on passing a stomach tube forty eight ounces of a similar fluid were obtained. Thereafter the vomiting ceased for three days.

On the fifth day after operation the patient again began to vomit, the vomitus being a dark brown fluid. Twenty four ounces were obtained on passing the stomach tube. On the ninth day the patient complained for the first time of slight abdominal cramps, the abdomen, however, was not distended; there was no visible peristalsis, and gas was being freely passed per rectum. Seventy ounces of fluid were obtained from the stomach. Thereafter the tube was passed regularly every eight hours, and always from six to fourteen ounces were obtained. On the eleventh and twelfth days the stomach was found to be empty, but the general condition of the patient deteriorated markedly. He was slightly stuporous and a urinous odor could be detected in the breath. The urine contained much albumin and many hyaline and granular casts. It was thought at this time that possibly the condition of the kidneys might account for part or the whole of the clinical picture.

On the fourteenth day the stomach was again emptied of thirteen ounces of fluid. The patient had complained of no pain, there was no abdominal distention and no visible peristalsis. On the evening of the same day, for the first time slight peristaltic erections were visible through the abdominal walls. General condition of the patient very poor. It was thought at this time that some form of ileus was present, and exploration of the abdomen was decided upon.

Operation by Dr. Wilensky. The abdomen was reopened in the line of the original incision, and owing to the wretched general condition of the patient this was done without general anesthesia. The stomach was found to be enormously dilated reaching almost to the pelvis while the small intestines which presented were collapsed. On drawing these aside it was seen that the duodenum and the afferent loop of the jejunum were also distended as far as the stoma and that the obstruction was formed by the efferent loop as it passed downward and to the right, turning sharply on itself toward the left and had insinuated itself in the artificial foramen formed by the afferent loop, the posterior parietal peritoneum and the under leaf of the transverse mesocolon as far as its fixation to the anastomosis. Almost the entire small intestine had folded and lay in the left half of the abdomen (Fig. 1). The mesentery of the small intestine where it was caught in the ring was somewhat swollen and edematous, and the margins of the ring were likewise infiltrated especially that part formed by the ligament of Treitz. The loops of intestine passing through the ring were nowhere adherent.

to its margins, and it was an easy matter to rapidly reduce the "hernia." The foramen was apparently stretched and admitted three fingers. It was obliterated by suturing the afferent loop to the ligament of Treitz. It could now be seen that the loop of jejunum at its application to the stomach was slightly twisted on its longitudinal axis. The abdomen was then rapidly closed by through and through sutures.

The patient bore the operation fairly well, on the next day a large mass was noted in the left submaxillary triangle, evidently a deep-seated abscess. The patient's condition rapidly became worse and death occurred the same day.

We were fortunate in obtaining a post-mortem examination, an abstract of which is herewith given.

Stomach is enormously dilated and contains forty ounces of poorly digested contents. Posterior gastro-enterostomy found in good condition. The jejunal loop, measured from the ligament of Treitz to the stoma, was about six centimeters long. The artificial foramen formed by this portion of the jejunum and the transverse mesocolon was almost obliterated by sutures passed between the jejunum and the ligament of Treitz. On opening the stomach the stoma of the gastro-enterostomy was found to be in good condition and the mucosa almost completely healed over it. Pylorus was patent. On the anterior wall of the stomach in the pyloric region was a layer of sutures, but no complete closure of the lumen of the pylorus had thereby been obtained. In the first portion of the duodenum about one centimeter from the pylorus there was a dense fibrous constriction, the lumen of which barely admitted the little finger. The mucosa on the gastric and duodenal sides of this constriction was whitened and presented a cup-shaped irregular depression, apparently the remains of a healed duodenal ulcer. The duodenum as far as the gastro-enterostomy was distended with small intestinal contents.

PREVIOUSLY REPORTED CASES

Steudel (1). A carcinoma of the stomach was extirpated in a woman 54 years of age and a posterior gastro-enterostomy made with a Murphy button, after the method of von Hacker. On the twelfth day there was sudden collapse, without any signs of obstruction, and the patient died five days later. At the autopsy, however, an obstruction was found, a short loop of small intestine having passed from right to left through the artificial foramen.

Peterson (2). The greater part of the stomach was resected for a pyloric carcinoma in a man 54 years of age and an anterior gastro-enterostomy made with a Murphy button. On the sixth day the patient went into collapse developed signs of obstruction, and died very soon thereafter. At the autopsy it was found that a large part of the small intestine had passed from right to left through the foramen.

Peterson (3). In a man 51 years old a posterior gastro-enterostomy was made after the method of von Hacker as a palliative measure for a carcinoma of the stomach. On the eighth day there developed mild symptoms of ileus and the patient died two days later with a well-developed pneumonia. At the post-mortem examination the whole of the small intestine was found to have passed from right to left through the ring.

William J. Mayo (4). An anterior gastro-enterostomy was made with a Murphy button in a man 41 years of age for an ulcer of the pylorus and lesser curvature of the stomach. On the fourteenth day there were signs of

intestinal obstruction, which lasted forty eight hours. On the sixteenth day the button was passed, and the patient was discharged well. At the end of a year the patient returned, complaining of constant pain above the umbilicus. At the operation the jejunum was found twisted on its longitudinal axis and had passed behind the afferent loop. The old gastro-enterostomy was divided and a new retrocolic anastomosis established. The final result is not given.

Gray (5). A posterior retrocolic short loop gastro-enterostomy was made by the suture method in a woman 31 years of age, with a typical ulcer history. Signs of obstruction developed on the sixth day, and on reopening the abdomen the whole of the small intestine was found to have passed through the ring from left to right. The ring was closed by suturing the inferior leaf of the mesocolon. The patient recovered.

Gordon (6). In a patient who was operated upon for intestinal obstruction, and in whom a gastro-enterostomy had been made previously, this variety of ileus was found, the gut having passed from right to left. No details are given. The patient recovered.

Barker (7). Two years after a posterior retrocolic short loop gastrojejunostomy had been made in a woman 28 years of age, the abdomen was again opened for intestinal obstruction. The whole of the intestine was found to have passed behind the afferent loop (the direction is not given in the report) and in addition the whole mass was twisted one complete revolution at the site of strangulation. The patient recovered.

After the completion of a posterior retrocolic gastro-enterostomy, the afferent loop of the jejunum is attached at two points, namely, at the duodenojejunal junction and at the stoma. This attachment forms an artificial foramen, the boundaries of which are approximately the following: posteriorly, the peritoneum lying in front of the vertebral column, superiorly, the inferior leaf of the transverse mesocolon, plus the gastrojejunal stoma, anteriorly and inferiorly, the afferent loop of the attached jejunum. The size of this foramen depends upon the length of the afferent loop of jejunum. Up to within the last decade, surgeons were rather liberal in estimating the required length of this loop, but lately brevity has been aimed at, and the former "long-loop" operations have been abandoned in favor of the "short loop" operation, frequently the statement is even met with that a "no-loop" operation was made. The latter, however, is manifestly impossible. To perform what would be literally a "no-loop" operation, the suturing would have to be done either within the abdomen at an impossible depth, or it would have to be done with so much twisting of the attached jejunum as to be fraught with unwarranted danger. In our own work we have always aimed to take the afferent loop as short as possible, and as short as would be commensurate with safety.

Furthermore, we have also aimed at one ad-

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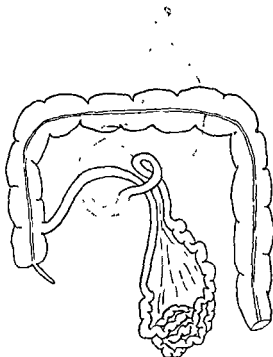


Fig 1 Diagrammatic illustration of intestinal obstruction found at secondary operation

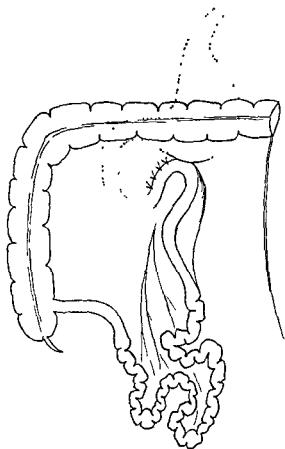


Fig 2 Diagrammatic illustration of obliteration of foramen formed in the course of gastro-enterostomy

very easily effected. This is reflected clinically in an atypical symptom-complex. The pain is vague, slight, or indefinite, peristaltic contractions are faint, not characteristic or absent, and small amounts of gas or feces may be passed from the rectum. Vomiting is usually present.

Assuming now that our criticisms and deductions are correct, it must be patent that there exists a slight fault in the technique of gastro-enterostomy as now executed, namely, that an artificial foramen is formed. Given such a foramen there exists always the possibility that, in a certain percentage, intestines or omentum will find their way into and through it and will cause symptoms. Naturally the number is small compared to the large number of gastro-enterostomies that are made, no more perhaps than with herniations through the foramen of Winslow, in which analogous conditions exist. The question therefore arises, How may we avoid the formation of this foramen? The solution of the problem appears to be very simple by the addition of the following step, namely, to suture the margins of the opening together, utilizing for this purpose the afferent loop of jejunum and the inferior leaf of the transverse mesocolon. Three or four sutures of Pagen-

stecher's thread appear to be ample to obtain a complete obliteration (Fig 2).

It is preferable to use the proximal loop, because whatever narrowing of the lumen may be caused thereby occurs in the loop, which serves merely for the transmission of bile and pancreatic juice. It is quite within the range of possibility, also, that such an anchoring may aid in the prevention of the formation of a vicious circle.

This little refinement practically amounts to only this much: that it converts the short-loop operation into a practically no loop operation.

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- 6 GORDON. Lancet, Lond, 1905 ii, 1477
- 7 BARAER. Lancet, Lond, 1904 ii, 1277

ditional point, namely, to place the stoma as far over to the right as possible. We have been fortified in this view by such an authority as Hartmann, who even advocates the placing of the stoma in juxtaposition to the pylorus. The afferent loop, depending upon its application at the site of the anastomosis, is turned either toward the right, and proceeds downward in the general direction of the right iliac fossa, or it follows its more natural inclination, and will proceed toward the left in the general direction of the left iliac fossa. The former is anatomically incorrect, but physiologically correct (isoperistaltic), while the latter will be anatomically more correct, but less so physiologically (antiperistaltic). Up to the experience related in the history of our case we had not taken any positive stand in the question of isoperistaltic and antiperistaltic attachment of the jejunum. Both methods have their warm advocates and adherents. We have decided the question from case to case, as it appeared to be most feasible and yet to do justice to the postulates previously mentioned. It is important to know here that in the case under discussion the isoperistaltic method was used.

A few surgeons, e. g., Kocher, make the incision into the intestine transversely to its long axis, but most surgeons make the incision parallel with its long axis, and we do not deviate from this method.

One other point which merits discussion is the direction of the incision in the stomach. Some surgeons clamp the stomach transversely to its long axis, the handles of the clamp being directed toward the head of the patient, the handles are then brought to the right of the patient, and the gastro-enterostomy is finished in this position. It is self evident that in so doing the portion of the stomach operated upon must be twisted through an arc of at least ninety degrees. We have always feared this twisting, and have therefore continued to make the incision parallel with and near the greater curvature of the stomach.

A certain amount of care is required in coapting the jejunum to the wall of the stomach. If this is executed in a haphazard and careless manner, more particularly if a Murphy button is used, a certain degree of rotation may be imparted to the jejunum, with the result that at the conclusion of the operation the coil of jejunum lies twisted on its longitudinal axis in an unnatural manner.

The physiological functions of the parts involved in the stoma usually lie dormant for some time after the completion of the operation, they therefore tend to retain the position imparted to them by the operator. Any twisting at the time

of the operation is likely to become even more accentuated. One of the reasons for these twists may be the gauze compress placed for the protection of asepsis behind the suture line. If clumsily executed, even the withdrawal of this gauze may initiate uncalled for twists. I have always taken the precaution to remove this gauze toward the right in the isoperistaltic attachment and toward the left in the antiperistaltic attachment.

If we now investigate the method of the operation as carried out in the present instance, the following points will become manifest:

- 1 At the time of the operation the stomach was enormously dilated, so that the ultimate stoma was certainly below the horizontal of the normal location of the duodenojejunal angle. It is quite possible that some blame is to be attached to this contingency, but we are inclined more to the belief that it would be more likely to result in some angulation and functional disturbance of the stoma, which, however, was not the case.

- 2 Attachment of the loop in an isoperistaltic manner.

- 3 Incision of the stomach parallel to the greater curvature.

- 4 The shortest possible loop was taken, as was still evident at post-mortem, when, even after stretching by the large amount of small intestine passing through the ring, it measured at most only six centimeters.

All in all, and without wishing in the slightest degree to find any justification for our methods or mistakes, we cannot find any deviation from the methods carried out in many other cases and in vogue with many, if not most, surgeons. On close scrutiny, about the only fault we can find is a fault which is inherent to the operation of gastro-enterostomy as such, namely, that an unnatural foramen is created within the abdomen, and it is well known that, in a certain percentage of these, loops of intestine or omentum will find their way into such an opening. Once a knuckle of gut has found an entry, the muscular contractions, as in a hernia, tend to become more violent and to insinuate more and more of the intestinal coils through the aperture, so that by the time these patients are operated upon, or come to autopsy, in nearly every case the entire small intestine has passed through the ring.

As a general rule, the ring is large enough to accommodate the two loops of intestine comfortably, and no actual strangulation occurs. The gut is usually not adherent to the margins of the ring, and reduction of the "hernia" is

Grashey, in 1905, reported having seen a fracture, but gave no details.

Momburg, in 1906, reports two cases, one a soldier who after jumping off a springboard had sharp pain in the right foot, especially marked in the ball of the big toe on walking, with marked sensitivity to pressure over the tibial sesamoid but with no pain on movement of the toe. Examination showed crossed division of the tibial sesamoid in the right foot. Similar finding also in the left foot, considered a congenital division. The second case was also in a soldier who complained of sharp pain under big toe after jumping off a wheel. Examination showed crossed division of the tibial sesamoid. Similar finding also in the left foot, considered a congenital division.

Momburg reviewed the previously reported cases and concluded that the cases of Marx and Schunke were examples of congenital division rather than fracture. Muskat's case was evidently one of true fracture. Momburg then reviewed a large number of radiographs and discovered nine cases of division of the sesamoids, five of these showing division into two parts, three into three parts and one into four parts. In the six cases in which both feet had been examined, the division was bilateral. The division was found to occur more frequently in the tibial sesamoid, and the line of division was usually transverse. Momburg believed the pain, swelling, and tenderness under the head of the big toe to be the result of an inflammatory reaction in the metatarsophalangeal joint.

Igelstein reports the case of a 22 year old student who slipped while skating. He suffered pain and tenderness in the region of the sesamoid with pain on strong dorsal extension. Examination showed a transverse division of the lateral sesamoid, believed by Igelstein to be congenital. The other foot showed division of the medial sesamoid.

Igelstein then entered into an exhaustive study of the subject and agreed with Momburg regarding the probable occurrence of congenital division in the cases reported by Schunke and Marx, but attempted to explain the clinical symptoms of pain, tenderness, and disability on the basis of a neuralgia excited by pressure of the partially dislocated portions of the sesamoid upon branches of the plantar nerves. He advocated rest and heat in treatment.

Stumme, in 1908, reported the case of a soldier who in running struck the end of his extended great toe against a pole. Examination disclosed a division of the sesamoid, and operation demonstrated the division to be a fracture. A second

case occurred in a laborer whose foot was run over by a wagon. Examination showed fracture of the first phalanx of great toe and an irregular fracture of the medial sesamoid into three parts. Subsequent examination showed partial healing of the sesamoid. Stumme attempted to produce fractures on the cadaver and succeeded in so doing, both by direct and indirect violence.

Morian, in 1908, reported five cases of fracture of the sesamoid. One case fell four meters, sustaining a fracture of the tibial sesamoid. Another dropped a piece of marble on the left foot, resulting in a fracture of the tibial sesamoid and a fracture of the metatarsal, both subsequently healed. The third dropped a piece of iron on the right foot with resulting fracture of the first metatarsal and a small chip fractured from the sesamoid. Subsequent examination showed healing. The fourth case dropped a stone on the dorsum of the foot, sustaining a fracture of the second, third, and fourth metatarsals and a longitudinal fracture of the inner sesamoid. Subsequent examination showed healing of the sesamoid. In the fifth case, a wagon wheel ran over the left foot causing a fracture of the metatarsal and a fissure of the inner sesamoid. Healing also occurred in this fracture. None of these cases showed pain on motion — only tenderness to pressure.

Painter, in 1910, reports a case in a man of 66. The division was believed to be congenital, as it was present also in the other foot. It was relieved by the application of plaster and later by a leather-and-felt support which protected the tender area from pressure.

Müller, in 1912, reports the case of a woman of 35 who was injured two years before by having the foot trod on while dancing. The acute symptoms soon disappeared, but there remained a residual soreness and pain on walking. Examination showed slight tenderness over the sesamoid bone of the left great toe. The X-ray showed a transverse separation of the tibial sesamoid. Fragments were removed in June, 1911. The patient reported, in October 1911, that she was relieved of all pain and disability. No mention is made of the condition of the sesamoid of the other foot.

Speed, in 1914, reports, without details, the operative treatment of five cases of fracture of the sesamoids, with satisfactory results. He does not mention of the possible occurrence of congenital division, and the question arises as to whether these cases were true fractures or not.

Geist, in 1915, in a study of one hundred clinically normal feet found division of the sesamoid in 16 per cent.

PSEUDOFRACTURE OF THE SESAMOID BONES OF THE BIG TOE

By W. W. BOARDMAN, M. D., SAN FRANCISCO

From the Stanford University Medical School

MY attention was first called to the possible occurrence of fracture of a sesamoid bone beneath the head of the first metatarsal by the following case:

Miss R., age 25, presented herself for examination in May, 1914, complaining, on walking, of pain under the base of the right big toe. Family and past history unimportant. She had had no trouble with her foot until 1906, eight years ago, when in hurrying upstairs her right foot slipped off the stair, causing extreme hyperextension of the big toe. There was some immediate pain, but no distress was noted during the following two hours while she was seated quietly. On attempting to walk, great pain was felt under the base of the big toe, and examination showed swelling in the region of the metatarsophalangeal articulation with tenderness to pressure on the plantar surface. With partial rest for a week the tenderness, swelling, and pain disappeared and she resumed her ordinary active life. During the next seven years she suffered no inconvenience except for an occasional sharp twinge of pain under the head of the first metatarsal bone, on walking. In 1913, while playing a hard game of tennis, she felt a sharp pain in the right foot, which persisted for several days, accompanied by swelling and tenderness to pressure under the big toe. With partial rest for a week the symptoms disappeared. A few weeks later the patient felt dull pain in the foot after dancing all evening. This pain persisted, being very severe on walking and on pressure. Strapping the foot in the region of the distal end of the metatarsals with adhesive gave relief, but the tenderness returned on removal of the strap. For the past few months the tenderness has been present off and on, usually only felt on walking, never felt at night. There may be a sharp pain for one or two steps and no more for the rest of the day. The patient states that she is troubled especially in the morning and after sitting still for a time. She has trained herself to walk on the outside of the foot with some relief.

Examination showed no appreciable swelling, pressure over the inner side of the distal end of the first metatarsal caused pain, no limitation of movement of the joint, no pain on extreme flexion or extension of big toe; however, pressure over tibial sesamoid was more tender during extreme extension. Slight tenderness was produced by extreme adduction, none on abduction.

Radiographic examination showed a definite separation of the tibial sesamoid into two portions by a lateral line of cleavage. The diagnosis was apparently fracture of the tibial sesamoid.

"Sesamoid bones are small rounded masses, cartilaginous in early life, osseous in the adult, which are developed in those tendons exerting a great amount of pressure upon the parts over which they glide. They are invested throughout their whole surface by the fibrous tissue of the tendon in which they are found, excepting on that side which lies in contact with the part over which they play, where they present a free articular surface."

The sesamoid bones beneath the head of the first metatarsal are two in number and are developed in tendons of the flexor brevis hallucis. This muscle divides near its insertion into two parts which are inserted into the inner and outer sides of the base of the first phalanx of the great toe, a sesamoid being developed in each tendon near its insertion. The articular surfaces of these sesamoids glide over articular surfaces on the plantar surface of the distal end of the first metatarsal bone. These articular surfaces are surrounded and lie within the joint capsule of the first metatarsophalangeal articulation. Between the sesamoids and protected by them runs the tendon of the flexor longus hallucis.

As regards the function of these bones, there is still some dispute, but they apparently act to distribute the weight to the distal end of the first metatarsal, and to protect the tendon of the flexor longus hallucis. Gillite believes that they play an important part in controlling all the movements of the big toe except extension, stating that the abductors and adductors are inserted into the sesamoids.

Clinically these sesamoid bones attracted no apparent attention until 1901, when Schunke reported the case of a laborer 40 years of age upon whose right foot a hard piece of clay weighing 100 kg fell. Examination showed a division of medial sesamoid which was considered a fracture.

In 1904, Stieda in a study of the sesamoids of the hands and feet mentions the occasional occurrence of anomalous division of the sesamoid bones of the great toe, and calls attention to the possibility of mistaking these for fractures.

Marr, in the same year, reported the case of a man of 40 years who fell three feet upon the right foot, sustaining an injury about the plantar surface of the distal end of the first metatarsal, with pain, swelling, and tenderness on pressure. Examination showed division of the medial sesamoid of the right foot—not present in the left foot. The case was believed to be one of fracture, and operative removal of the fragments was recommended, but refused.

Muskat reported the case of a 50 year old patient who caught his foot in a hole. An examination discovered a T-shaped division of the sesamoid. He was treated by a protective shoe. Subsequent X-ray showed healing.

fractures in metatarsals or phalanges, by the absence of division in the other foot, and, finally, by the appearance of healing. However, none of these points but the last is absolute.

5 That the symptoms in cases of congenital division probably result from an inflammation in the metatarsophalangeal joint.

6 That rest and protection will usually give relief, this failing, operative removal may be recommended.

7. That true fractures of the sesamoids will spontaneously heal with good clinical results. Satisfactory results are also reported after operative removal.

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- 4 MESSKE *Deutsche med Wchnschr*, 1906, xcvi, 1310
- 5 MEMBERG *Deutsche Ztschr f Chir*, 1907, lxxvii, 382
- 6 ICELSTEIN *Deutsche Ztschr f Chir*, 1908, xciii 505
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- 9 PAINTER *Boston M & S J*, 1910, cxiii, 363
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CLOSURE OF RIGHT RECTUS INCISION

By CHARLES R. ROBINS, M.D., I.A.C.S. RICHMOND, VIRGINIA

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THE right rectus incision gives the most useful and varied exposure of the abdomen.

In acute appendicitis the field is larger and greater freedom is offered for dealing with complications that are not infrequently present, such as an appendix with adhesions, an appendix in the pelvis or in other unusual positions that cannot always be ascertained previous to operation.

In chronic appendicitis with marked digestive disturbance, the necessity of exploring the gall-bladder, pylorus, and pancreas is generally conceded, and in certain other cases where a positive diagnosis cannot be made a general survey of the field is demanded. The right rectus incision is here a necessity, as well as in operations for frankly obvious disorders of the gall-bladder and stomach, malignant disease of the first half of the large bowel, and a number of other conditions unnecessary to mention.

The chief embarrassment in the employment of this incision consists in the difficulty of making a smooth and satisfactory closure of the wound. First of all there is a tendency for the intestines and omentum to bulge into or extrude from the wound as a result of respiration. If the abdominal contents are covered over with a gauze sheet the omentum and intestines are nevertheless pulled out when the sheet is withdrawn and are very difficult to replace. The use of various spoons and trowels is an improvement but is by no means

satisfactory, for after these devices are withdrawn and before the wound is finally closed, protrusions often occur and are time consuming and difficult to get back, to say nothing of the wear and tear on the surgeon's disposition.

Another problem is the tearing out of the suture used to close the peritoneum and the posterior sheath of the rectus. McArthur has called attention to this in an article in the January, 1915, number of *SURGERY, GYNECOLOGY*

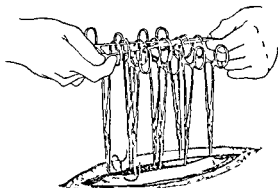


Fig. 1. Application of forceps upward even traction and stitch started. Any amount of traction may be applied as the number of forceps distributes the pull and there is no danger of tearing out. Elevation of abdominal wall away from intestines prevents bulging and extrusion. When the abdominal wall lies flat on viscera they act as a valve and each respiration forces them out.

From this brief review it is evident that a congenital division of the sesamoids may occur, usually involving the tibial sesamoid, and that after trauma, both direct and indirect, symptoms may occur which are identical with those seen after true fracture of these bones.

The experimental work of Stumme and of Morian as well as the case reports of Muskat, Stumme, Morian and Müller, definitely establish the occurrence of fracture of the sesamoids after direct and indirect trauma.

A suggestion offered by Igelstein to explain the occurrence of congenital division is that the sesamoids are formed by two centers which later fuse. A partial fusion results in the notched sesamoid noted by Mesbitt, a complete failure of union results in the divided sesamoids.

In all of these cases the common etiological factor has been trauma, either direct or indirect. The symptoms in all have been practically identical, pain beneath the distal end of the first metatarsal, greatly increased by pressure or by walking, some swelling, but practically no pain on movement of the big toe. After the acute symptoms have subsided, tenderness may persist for a considerable period, being excited by pressure over the sesamoid and by walking.

The symptoms occurring in the cases of congenital division have been explained by Momburg as the result of inflammation in the first metatarsophalangeal joint. The trauma presumably causes slight dislocation of the segments of the sesamoid with some resulting increase in mobility sufficient to keep up the low grade inflammation. Igelstein does not accept this explanation basing his objection on the ground that if the symptoms were dependent upon an arthritis there should be pain on movement of the joint. After rejecting localized inflammation of the tend or sheath and localized periostitis as possible causes, he concludes that the symptoms result from a neuralgia excited by pressure on the smaller branches of the plantar nerves by the displaced and abnormally movable parts of the divided sesamoid. This latter explanation is hardly satisfactory and it seems probable that as Momburg suggests, the symptoms are dependent upon an inflammation of the capsule of the metatarsophalangeal joint.

The differentiation between cases of congenital division and true fracture is often difficult, as the exciting trauma and the clinical manifestations may be the same in both. The X ray in the fracture cases may show an irregular line of division between the fragments instead of the smooth line seen in the cases of congenital

division. The line of division in the congenital cases is usually, though not always, transverse, in the true fracture it may be in various directions. In fracture by direct violence there is frequently fracture of the metatarsals or phalanges as well as of the sesamoid. The presence of division of the sesamoid of the other foot speaks against fracture. True fractures often show processes of repair in the course of time.

As regards the therapy, there is also a difference of opinion, some recommending rest and protection, others operative removal of the fragments. The cases of Muskat and Morian demonstrate that true fractures may heal with satisfactory results,—those of Momburg and Painter that the pseudofractures may be relieved without operation. Stumme, Müller, and Speed report satisfactory results in true fracture after operation, Speed recommending the removal of both sesamoids. No case of pseudofracture operated upon has been reported. It would seem advisable in handling these cases of either type to try rest and protection first, resorting to surgical removal only after this has failed.

During the last year I have seen four other cases showing division of the sesamoids.

One, Mr. J. P., a laborer age 40 who struck the distal end of the foot with a pick while standing on hard clay. This was followed by tenderness and pain beneath the head of the first metatarsal. A ray showed crossed division of the medial sesamoid but present in the other foot. The patient was not relieved after five months of partial rest. The divided sesamoid was then removed. Examination of the bone showed no fracture. This was therefore a case of unilateral congenital division. The pain and tenderness have been relieved by the operation.

The second case, Mr. L., a middle aged laborer dropped a barrel on his left foot. He complained of some pain in instep and under big toe. The X ray showed transverse division of tibial sesamoid present also in the other foot. Symptoms slight and patient has not returned. This is probably a case of congenital division.

The other two cases are in women in whom division of the tibial sesamoid was found by accident. Both are evidently cases of congenital division.

In conclusion we may say:

1. That a congenital division of the sesamoid bones of the big toe is occasionally found, especially in the medial sesamoid.
2. That fractures of these bones may be produced by direct and indirect violence.
3. That direct or indirect violence applied to a foot with a congenitally divided sesamoid may give rise to signs and symptoms identical with those produced by fracture.
4. That true fractures may possibly be recognized by the more ragged appearance of the line of cleavage, the possible occurrence of other

divided among them all. The traction must therefore be made evenly on all the forceps. This can be accomplished either by the assistant's holding them in his hand or by threading the rings of the forceps on another pair of forceps held horizontally. In this latter case the ring pointing over the wound should be used, and the forceps should be threaded on alternately, first from one side and then from the other. In this way the forceps act on an easy pivot and the act of pulling upward has a tendency to pull the edges of the wound together.

Step two Introduction of suture. While traction is being made, the suture is fixed at the upper angle by taking a bite in the sheath above the forceps attached in the upper angle of the wound and tying at this point. A continuous mattress suture is then passed back and forth across the wound, in each case taking out all the slack in the stitch but never making any tension. If tension is made on any loop singly it may pull out. After the stitch has been placed for the entire length of the wound in this manner and while upward traction is made on the attached forceps, the suture is drawn taut by pulling on the end, while the assistant detaches the forceps that have been used for making traction upward. The same principle applies here in that the

distribution of traction by suture, being applied simultaneously at all points of penetration for the whole length of the incision, makes the edges come snugly together without any tearing out, and at the same time the peritoneal margins are everted so that there are no raw surfaces exposed toward the abdominal contents for formation of adhesions. The catgut suture likewise is not exposed in the peritoneal cavity.

Step three. The wound is then closed in the usual manner, silkworm gut sutures are introduced in figures-of-eight, the lower loop passing through muscle as well as fascia and also including the everted edge of the peritoneum and posterior sheath of the rectus. The continuous catgut suture used for closing the peritoneum is used for uniting the fascia and the fat, the skin is closed with a subcuticular stitch of silkworm gut and then all the figures-of-eight stitches and the ends of the subcuticular stitch are tied over a gauze pad. This latter prevents the stitches cutting into the skin and adds greatly to the comfort of the patient.

I have used this method of closure in the most difficult cases and have yet to experience a failure. I believe its employment will remove the chief embarrassment experienced in employing the right rectus incision.

BOOKS RECEIVED

Books received are acknowledged in this department and such acknowledgment must be regarded as a sufficient return for the courtesy of the sender. Selections will be made for review in the interests of our readers and as space permits.

A REFERENCE HANDBOOK OF THE MEDICAL SCIENCES. EMBRACING THE ENTIRE RANGE OF SCIENTIFIC AND PRACTICAL MEDICINE AND ALLIED SCIENCE. Third edition revised and rewritten. Edited by Thomas Lathrop Stedman. M. M. D. New York: William Wood & Company. 1915.

THE CLINICS OF JOHN B. MURPHY, M.D., AT MERCY HOSPITAL, CHICAGO. Vol. IV. Nos. 1, 2, and 3. Philadelphia and London: W. B. Saunders Company, 1915.

MOTHERCRAFT. By Sarah Comstock. New York: Hearst International Library Company, 1915.

INFECTION AND IMMUNITY. A textbook of immunology and serology. For students and practitioners. Third edition. By Charles I. Simon. B. A. M. D. Philadelphia and New York: Lea & Febiger, 1915.

MATERIA MEDICA AND THERAPEUTICS. A textbook for nurses. By Loretta A. Parker. B. Sc. R. N. Philadelphia and New York: Lea & Febiger, 1915.

THE GOLDFINGER CASE. New York: Paul B. Hoeber, 1915.

MEDICAL ETIOLOGY. By Woodruff. New York: Reblin Company, 1915.

INDISPENSABLE ORTHOPEDICS. A handbook for practitioners. By J. Calot. Translated from the sixth French edition by A. H. Robinson. M. D. F. R. C. S. and Louis Nicole. Vols. I and II. St. Louis: C. V. Mosby Company, 1915.

AN OPERATIVE THEATER IN PRIVATE PRACTICE. By C. Humilton Whiteford, M. R. C. S. L. R. C. P. London: Harrison & Sons, 1915.

OUTLINES OF INTERNAL MEDICINE. For the use of nurses. By Clifford Bailey. B. A. M. D. Philadelphia and New York: Lea & Febiger, 1915.

COLLECTED PAPERS OF THE MAYO CLINIC. Rochester, Minn. Vol. VI. 1914. Edited by Mrs. M. H. Mellish. Philadelphia and London: W. B. Saunders Company, 1915.

GENERAL INDEX TO THE ANNALS OF SURGERY. Vol. 1 to 4. Edited by Lewis Stephen Pichler. M. D. B. S. Philadelphia: Annals of Surgery, 1915.

THE NEXT GENERATION. By Frederick A. Rhodes. M. D. Boston: Richard G. Badger. The Gorham Press.

THE INTERVERTEBRAL FORAMINA IN MAN. The morphology of the intervertebral foramina in man including a description of their contents and adjacent parts with special reference to the nervous structures. By Harold Swanberg. With an introductory note by Professor Harris I. Santee. Chicago: Chicago Scientific Publishing Co., 1915.

BOOK REVIEWS

CRITIQUE OF NEW BOOKS IN GYNECOLOGY AND OBSTETRICS

By GEORGE GETHORN, M.D., St. Louis, Missouri

TWO noteworthy additions to our gynecological library came to us from Germany a short time before the cataclysm in Europe engulfed all other interests. The first of these two books deals with the pathologic anatomy and histology of the female genital organs. Of this work the reviewer can speak only in words of highest praise. It does not often happen in these days of literary overproduction that a book answers a crying need. The book before us holds this distinction. The first and only modern treatise on gynecologic pathology was published by Gebhard in 1899. His untimely death prevented the author from revising his book and bringing it up to date. It was left to Frankl in 1914 again to treat of this subject and to embody in book form the numerous additions to our knowledge and changes in our conceptions of pathologic processes in the female genital sphere that have taken place in the last fifteen years—a difficult undertaking if we consider that the material lay scattered in innumerable books and single reports. To collect and critically analyze this almost overwhelming mass of evidence required not only a complete familiarity with the literature but also extensive personal experience and mature judgment, all of which have enabled the author to present his studies within the small compass of 300 pages.

The subject matter is arranged according to organs and includes not only pathologic alterations but also malformations. To choose a few illustrations. The discussion of the so-called glandular endometritis (p. 2) is based upon the researches of Hirschmann and Adler. A hyperplastic endometrium occasionally may become inflamed like any other mucosa but under no circumstances is hyperplasia the result of inflammation. Nor are cervical polyps of inflammatory origin. Inflammatory changes in polyps if present are secondary in character (p. 14). The appearance of cylindrical epithelium upon cervical erosions signifies to Frankl the beginning of healing (p. 31). Metritis is a misnomer in so far as it represents a hyperplasia of the muscularis, not an inflammation (p. 36). Contrary to von Recklinghausen, Frankl ascribes the origin of adenomyoma to remnants of the Wolffian body only if the tumors are located in the uterine

horns (p. 32). Membranous dysmenorrhea is still an obscure condition; inflammation, however, may be excluded as an etiologic factor (p. 39). Frankl denies the persistence of menstruation in pregnancy; there may be bleeding at menstrual dates in pregnancy, but no true menstruation (p. 111).

The histology of hydatiform mole (p. 122) and its relation to chorio epithelioma (p. 143) receives careful consideration. The cells of malignant chorio epithelioma possess all the destructive qualities of normal chorionic cells in the first weeks of pregnancy. But, while under normal conditions the serum of pregnant women dissolves chorionic cells when they enter the maternal circulation, the blood of women with chorio epithelioma has lost its syncytiolytic quality. Cases of spontaneous cure of chorio epithelioma may, therefore, be explained by a timely return of this biochemical property.

A hydrosalpinx need not always be of gonorrheal origin as is usually assumed. Frankl has found in such a tube staphylococci in pure culture (p. 160). Any salpingitis may heal eventually, but after severe inflammation *restitutio ad integrum* is inconceivable; the fibrous thickening of the walls of the tube, peritoneal alterations and tubal occlusion prevent a complete return to normal conditions (p. 162). Abdominal pregnancy is generally supposed to be secondary to tubal gestation. Frankl, however, is inclined to believe also in a primary insertion of the ovulum upon the peritoneum (p. 173). Cystic degenerations of the ovary are to be considered as retention cysts (p. 194) and the term oophoritis should be restricted to actual inflammation due to bacterial invasion (p. 185). The histogenesis of pseudomucinous cystadenomata of the ovary is still unsolved (p. 204). Frankl does not accept Pfannenstiel's theory of their origin from follicular epithelium and would rather classify them as congenital teratogenous new growths.

From these few selections taken at random, the wealth of instruction and stimulating thought one receives in studying this book may readily be inferred. The diction is simple and direct and without any slight difficulty even to those only moderately well versed in the German language.

Moreover, the benefit is greatly enhanced by an abundance of most excellent pictures, both microscopic and macroscopic. The latter in particular may be declared flawless. These colored reproductions are so perfect that their inspection through an

Frankl's Gynecology and Obstetrics. By GEORGE GETHORN, M.D., St. Louis, Missouri. Published by the W. B. Saunders Company, Philadelphia, 1914. Pp. 300. Price, \$2.50.

ordinary magnifying glass renders a microscope unnecessary. Good illustrations are, indeed, one of the most important means of instruction and should be demanded of any book that purposes to teach.

The book, as is customary, is dedicated to the use of the general practitioner, but this object will, I fear, remain a pious wish. Only the last generation or two of young physicians have been taught to regard pathology as the foundation of all their medical knowledge. The majority of general practitioners consider pathology and what the microscope may reveal more as a sort of scientific bric à brac, but the ideal practitioner of the future will perhaps recognize that a personal understanding of histologic changes is as indispensable to him as the lessons learned from the thermometer or the stethoscope in other fields of medicine.

In the meantime, every gynecologist and every pathologist will rejoice in possessing and freely consulting a book the merit of which can not be questioned. The publishers deserve our thanks for bringing out so splendid a book, and we may generously overlook the heavy and glossy paper so commonly used in German scientific works instead of the light and pliable paper which constitutes one of the chief attractions of British publications.

For the sake of making this work accessible to a very large circle of readers, it is to be hoped that an English translation will soon be forthcoming.

THE second book¹ is a heavy tome of 823 pages, with 19 colored plates and 115 illustrations. It has been written by two authors, Ludwig Fraenkel and Rudolf Theodor Jaschke and is divided into two large sections entitled respectively "Sexual physiology of woman in health and disease" and "Physiology and pathology of labor."

The arrangement of the 17 chapters may convey a preliminary idea of the contents of this volume. The first six chapters deal with the formation and maturation of the follicle, ovulation and internal secretion of the ovary, sexual instinct and its gratification, conception, formation of the decidua and nidation of the ovulum, and finally, the physiology and pathology of pregnancy together with the normal and pathologic physiology of the membranes and the amniotic fluid. Chapter VII treats, in about 220 pages of the physiology and pathology of labor. Puerperium and lactation are discussed in Chapters VIII and IX while the two following chapters are devoted to the physiology and pathology of menstruation. Chapter XI deals with childhood, puberty and climacterium. Chapter XII presents facts and theories regarding the determination of sex. In Chapters XIII and XIV the relations of the glands with internal secretion to the genital function and the special activity of the

ovarian secretion are put before us. The physiology of the genital tract from the tube down to the vulva is dealt with in Chapter XV, and the relation of the sexual function to other organs is given in Chapter XVI. The concluding chapter offers an outlook upon the finer relations between sexual physiology and tumor formation.

In this bewildering richness of material a few leading principles soon became apparent.

To begin with, there is the general scheme, a discussion of pathologic functions in close connection with normal functions. Cohnheim, in his "General Pathology," has defined disease as the peculiar, i. e., abnormal, course of the same processes which represent the manifestations of life in the healthy organism, and Krehl, some ten years ago, embodied in his "Pathologic Physiology" the problems that confront the medical clinician. In the book before us we find a similar principle applied to gynecology and obstetrics.

The usual division into gynecology and obstetrics is, however, abolished in this book. Gynecology, in a wider sense, comprises both branches just as in actual practice they merge into one another. Pregnancy with all that appertains thereto is but one of the phases of woman's life and the functions of her genital organs, and we find in the book a consistent effort to treat it as such.

The influence of recent biologic studies upon our special field is comprehensively discussed. More than ever before have analogies with animal physiology been taken into consideration. In fact the reference to biologic phenomena can be traced like a red thread throughout Fraenkel's treatise. Himself an authority on the subject the writer is the competent man to develop for us the all important significance of the glands with internal secretion in the sexual sphere of woman, and while we are made to realize that only a beginning has been made, yet a wide outlook opens before our eyes and exerts a stimulating effect upon our thoughts.

That gynecology is more than a mere surgical specialty must have become apparent from the foregoing appreciation, and this principle, with which the reviewer is in hearty accord, justifies the inclusion in this book of such questions as determination of sex, development of secondary sexual characters, sexual psychology of woman, education of girls, selection of vocations, influence of clothing and of sport upon the genital function, etc.

In the chapter on physiologic and pathologic labor written by Jaschke the application of physical principles upon the process of parturition represents the dominant note. The teachings of Sellheim are given just preëminence and in addition, the literature of the world is well utilized.

After these remarks, necessarily brief and incomplete though they are in order not to exceed the scope of a book review it seems superfluous to point out particularly interesting details such as present themselves almost on every page, and only a very few selections may here follow.

¹ KÖNIGSDESSEN'S HANDBUCH DER GESAMTEN FRAUENHEILKUNDE. GYNEKOLOGIE UND GEBURTSHILFE FÜR DEN PRAKTIKIERENDEN ARZT. VON L. FRAENKEL. Volume III. Normale und pathologische Sexualphysiologie des Weibes, by Ludwig Fraenkel. Physiologie und Pathologie des Labors, by Rud. Th. Jaschke. Leipzig: F. C. W. Vogel 1914.

Ovulation, according to Fraenkel (and others), occurs approximately between two menstruations, and very likely is the cause of the so-called *Mittelschmerz*, the etiology of which had heretofore not found a satisfactory explanation (p. 10). The time of occurrence of ovulation must, also, influence our views regarding the duration of pregnancy, which lasts from 10 to 14 days less than previously assumed (p. 170). The frequency of small cystic degeneration of the ovaries should, in the absence of other tangible causes, be attributed to sexual irritation (p. 14). The corpus luteum is formed within three days after ovulation and is derived from epithelial cells of the *membrana granulosa* (*glande epithéliale* of the French). In addition there is formed an interstitial gland from connective tissue elements of the *theca interna*, this gland, while very prominent in animals, is only rudimentary in the human species (p. 32).

As a result of fourteen years of experimental research, Fraenkel formulates a "corpus luteum law" as follows:

1. The corpus luteum produces in the endometrium premenstrual changes which are indispensable for the nidation of the ovulum: the *proestrus* (p. 108).

2. This function of the corpus luteum is not limited to one cycle of four weeks but persists throughout the age of reproduction as the corpora lutea closely follow one another. Their totality represents a distinct new organ: the *glandula lutea* which supplies a constant stimulation that prevents the genitalia from retrogressing into the infantile or progressing into the senile stage. If the *proestrus* is the single function, the total turgor of the years of reproduction is the permanent effect of the corpus luteum (p. 331).

Menorrhagia is due to hæmophilia more often than is usually assumed (p. 540). Hyperplasia of endometrium and endometritis cause increase of discharge, but not bleeding (p. 541). The indiscrete use of the curette is properly stigmatized, always by referring to biologic factors which are at fault (p. 549). The therapeutically efficient agent of the pituitary body is very likely contained, not in the posterior lobe, but in the intermediate part (p. 662).

But enough of such details. It must already be obvious to the reader that we have to deal with an unusual book — let me add, a most interesting

and fascinating book — in which an experienced physician and carefully observing scientist speaks to us. That not every one of his views meets with our approval, does not constitute an unfavorable criticism. That in some of the theories advanced the exact scientific proof is still outstanding, is admitted by the author himself, yet we must agree with him that a working hypothesis is better than none at all.

There is no fault to be found in the book as such that I can see, but I believe that it altogether misses the purpose for which it was written. Its title proclaims it for the use of the general practitioner. What was said above in this connection of the book of Frankl is even more true in regard to the work by Fraenkel and Jaschke. Why are all medical books inscribed to the general practitioner? There should be a closed season in books for the poor, overworked general practitioner so that he may find time now and then to look over his reference books of his medical school days. No, *this is a book on gynecology for gynecologists* and it should be studied most earnestly by all who profess this specialty.

These two books, a review of which has been attempted in the foregoing, form the second and third volumes respectively of a new work edited by W. Liepmann, of Berlin, under the title: *Short Handbook of the Future Gynecology*. The seven volumes of which this "short" handbook is to consist prove the title to be a misnomer, but if the other volumes come up nearly to the standard set by the two forerunners, we might well overlook the *lupus lingus* and look forward to the completed set with eager anticipation. The combination of gynecology and obstetrics within the bounds of one work has previously been attempted by a few authors at an earlier stage of development of our specialty. The idea is very attractive, but it has this disadvantage, that repetitions are unavoidable. The announcement of the publishers gives a long list of names of collaborators. In other words, there will be in these seven volumes a number of monographs and these are bound to present differences of views. This would be a drawback were the work to be perused by the general practitioner, but as I believe that it will be read mainly by specialists whose personal experience will enable them to study it critically, this apparent disadvantage will prove only an additional attraction.

Clinical Congress of Surgeons of North America

SIXTH ANNUAL SESSION

BOSTON

OCTOBER 25 TO 29, 1915

CLINICAL CONGRESS OF SURGEONS OF NORTH AMERICA

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THE CLINICAL CONGRESS OF SURGEONS IN BOSTON

The sixth annual session of the Clinical Congress of Surgeons of North America, to be held in Boston the week of October 25, 1915, will be conducted along the same general lines as previous sessions of the Congress in the United States except that, following the precedent established at the fifth session held in London in July, 1914, the number in attendance will be limited. A careful survey has been made of the operating amphitheaters, lecture rooms and laboratories of the several medical schools and hospitals which are cooperating, by the Boston committee on arrangements to ascertain exactly the number of visiting surgeons that can be comfortably cared for at all times and the limit of membership fixed in accordance therewith. There will be a place for each surgeon who receives a membership card. Advance registration is therefore required. At this date the membership list for the Boston session is nearly complete. A formal receipt is mailed to each member upon payment of the registration fee, which receipt is to be exchanged for a membership card

upon presentation of the receipt when registering at headquarters during the session. When the registrations have reached the required number no further cards will be issued.

SPECIAL TICKETS

The use of special tickets at previous sessions has fully demonstrated the efficacy of this method of providing for the distribution of the visiting surgeons among the various clinics and demonstrations, preventing overcrowding, as tickets for any one clinic or demonstration are limited in number to the actual capacity of the room in which the clinic or demonstration is to be given. Special tickets will be issued for all clinics and demonstrations, and will be distributed daily at headquarters after the clinical program for the day has been posted on the bulletin boards.

HEADQUARTERS

Headquarters will be established at the Copley Plaza, Boston's newest hotel, which is centrally located in the Back Bay district and from which

any of the hospitals and medical schools can be reached in a few minutes. The hotel is located only a block and a half from the Back Bay and Huntington Avenue railroad stations. The Congress headquarters will be on the ground floor of the hotel where there is ample space for the registration and ticket bureaus, bulletins, etc. The large ball room in which the evening meetings are to be held is also located on the ground floor.

REGISTRATION FEE

The constitution of the Congress provides that a registration fee shall be required of each member attending an annual meeting. There are no annual dues. The registration fees provide the funds to meet the expense of preparing for and conducting the annual meetings so that no financial burden is imposed upon the members of the profession in the city entertaining the Congress.

CLINICAL PROGRAM

The schedule of clinics and demonstrations as published in these pages is a provisional one, and is to be rearranged and amplified during the weeks previous to the Congress. The real program of the Congress is the schedule of clinics and demonstrations which is posted each afternoon on the bulletin boards at headquarters giving in detail the cases to be operated on or demonstrated at each clinic.

The committee on arrangements has planned that there shall be a complete showing of Boston's clinical facilities in every department of surgery, including gynecology, obstetrics, genito-urinary surgery, orthopedics, and surgery of the eye, ear, nose and throat. In addition there will be a series of demonstrations and lectures on borderline subjects given by a number of eminent Boston surgeons and internists.

HOTELS

The executive committee is informed that the Boston hotels are usually well filled at this season of the year, and would strongly urge members to

make their hotel reservations at once. Other first-class hotels in the vicinity of the Copley Plaza (the headquarters) are: The Lennox, Brunswick, and Victoria.

EVENING MEETINGS

The Executive Committee of the Congress has arranged for meetings on four evenings of the week. The presidential meeting will occur on Monday evening, at which time the President-elect, Dr. Charles H. Mayo, will deliver the annual address. On Tuesday, Wednesday and Thursday evenings there will be two meetings, one for the section on general surgery, the other for the section on surgical specialties. The principal papers will be read by visiting surgeons and will be discussed by Boston surgeons.

REDUCED RAILWAY FARES

On account of the Boston meeting the railroads in the eastern portions of the United States and Canada have granted certain reductions in fares in selling round trip tickets. In the eastern part of the United States the fare will be two cents per mile in each direction, going and returning via the same route only, and over which one-way tickets are regularly sold. This rate will be in effect in the territory covered by the railway lines in the New England Passenger Association, Trunk Lines Association, Southeastern Passenger Association and Central Passenger Association, which covers practically all of the states east of the Mississippi River. Members living in the Western Passenger Association territory, that is, west of Chicago and St. Louis, should purchase tickets to the above gateways and then repurchase a round trip ticket to Boston in order to avail themselves of the special reduced fares. In Canada practically the same rates prevail as far west as Port Arthur. Tickets will be sold from all points on October 22, 23 and 24 with a final return limit to reach one's original starting point on or before midnight of November 3.

THE MEDICAL SCHOOLS AND HOSPITALS OF BOSTON

IV. A GROUP OF BOSTON'S PUBLIC HOSPITALS

MASSACHUSETTS GENERAL HOSPITAL

In 1810, Dr John Collins Warren, nephew of Joseph Warren who fell at Bunker Hill, and Dr. James Jackson signed a letter which set forth the need of the proposed Massachusetts General Hospital and which really began the foundation of the hospital. After detailing the proposed services to the poor, and stating the advantages for medical education, the letter ended with an appeal just as urgent now as it was then "To what other objects can the superfluities of the rich be so well bestowed?"

The following year, 1811, the General Court of Massachusetts granted a charter for the projected hospital. From the beginning, the en-

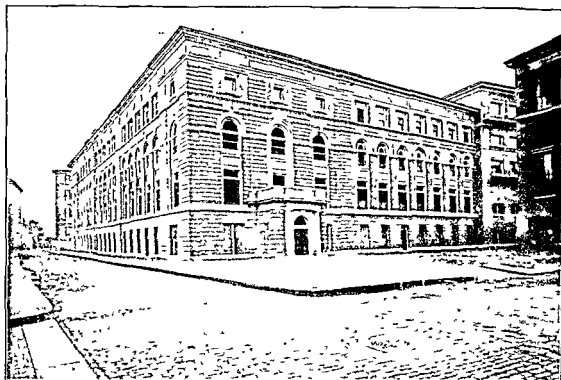
terprise was intended to care for the insane as well as the acutely sick and wounded. On July 4, 1818, the corner stone of the present hospital was laid and patients were admitted in 1821, with Dr. Jackson and Dr. Warren as physician and surgeon in charge.

In 1846, ether was first administered to full surgical anaesthesia in the hospital and in commemoration thereof the following inscription appears in the dome of the hospital:

On October 16, 1846, in this room, then the operating theatre of the hospital, was given the first public demonstration of anaesthesia to the extent of producing insensibility to pain during a serious surgical operation Sulphuric ether was administered by William Thomas Green Morton, a Boston dentist. The surgeon was John Collins Warren. The patient



Massachusetts General Hospital Bulfinch Building
In the Dome of This Building Ether was First Given to Full Surgical Anesthesia October 16, 1846



Massachusetts General Hospital Out Patient Building

declared that he had felt no pain during the operation and was discharged well December 7th. Knowledge of this discovery spread from this room through out the civilized world. And a new era for surgery began.

The contrast between the number of patients in the early days and those treated last year is interesting. By gradual growth, the facilities of the hospital, by means of 333 beds last year, enabled the physicians and surgeons to care for 6,712 patients in the wards. The number of visits in the out patient department was 158,090 or an average daily attendance of 520 patients.

The hospital beds are divided among two medical and two surgical services, an orthopedic service, a genito-urinary service, and throat and skin services. The south medical department, which treats syphilis alone, has four beds at its disposal. In connection with the out patient department there is a hydrotherapeutic department and a medicomechanical department for the treatment of chronic lesions of the muscles and joints by means of apparatus.

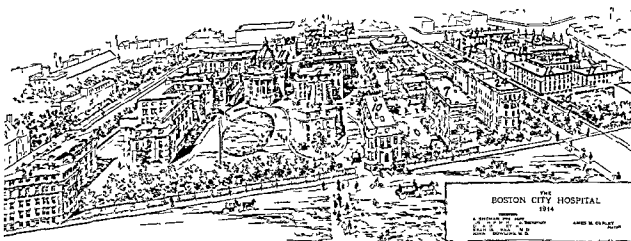
The hospital is not in any way a state institution. It is supported solely by voluntary gifts

and the receipts from those patients who pay board.

Every institution has its own particular points of interest. At the Massachusetts General Hospital the thorough care of patients who have been treated in the wards is carried on by the follow up system. This means that at the end of a year each surgical ward patient is requested to return for an examination, and the results of his hospital treatment noted. This idea is extended so that a patient is sent for if he does not keep his appointment for treatment and if the treatment is unsuccessful for one reason or another the home surroundings or other sources may be surveyed.

The relation of occupation to disease has received considerable attention. Future legislation in connection with occupations and occupational diseases will doubtless be guided by such statistics.

The Social Service, which is a pioneer in this line of endeavor, gives invaluable assistance to the staff and the social history supplementing the medical enables the physicians to accomplish better results.



Birdseye View of Boston City Hospital

A cement shop to enable needy handicapped patients to tide over the period of incapacity and discouragement, has proved its value as a source of livelihood and moral encouragement to the workers

To one interested in administrative problems there are several matters of interest, such as the methods used to eliminate waste by washing and sterilizing used gauze and bandages, inspection of garbage, ward and kitchen inspections, appliances and methods employed to reduce noises in a hospital, manufacture of picked cotton from discarded white goods

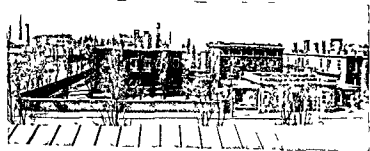
BOSTON CITY HOSPITAL

The Boston City Hospital was dedicated May 24, 1864. At that time it consisted of three buildings, at the present time there are forty-six

These buildings occupy 30 $\frac{1}{4}$ acres and the total valuation of land and buildings is \$3,586,100. The hospital controls more than 1,000 beds, which are divided among the medical, surgical, gynecological and genito urinary services, and a department for the treatment of scarlet fever, measles and diphtheria.

In addition to the above mentioned departments, the hospital has a large out-patient department, a convalescent home, and relief stations designed for caring for acute emergencies at Haymarket Square and in East Boston. The pathological laboratory, under Dr. Mallory, and the X-ray department, under Dr. Williams, are noteworthy.

During the year ending January 31, 1914, 18,077 house patients were treated at a cost per patient of \$1.81 per day. In the same year,



Boston City Hospital South Department, Contagious Diseases



Boston City Hospital East Boston Relief Station



Boston City Hospital, Haymarket Square
Relief Station

98,652 out-patients were treated. There are 103 members of the medical and surgical staff and 42 house officers.

The department for contagious diseases (scarlet fever, diphtheria, and measles) is known as the South Department. In 1888 separate wards were set aside for these diseases, but these accommodations soon proved inadequate and in 1895 the South Department was opened. This department, although an integral part of the hospital, is an entirely separate department.

It was in these buildings that Dr. John McCollom demonstrated the value of antitoxin in the treatment of diphtheria, and reduced the death rate from 38.10 in 1894 to 9.48 in 1913. The department is now directed by Dr. Edwin H. Place.

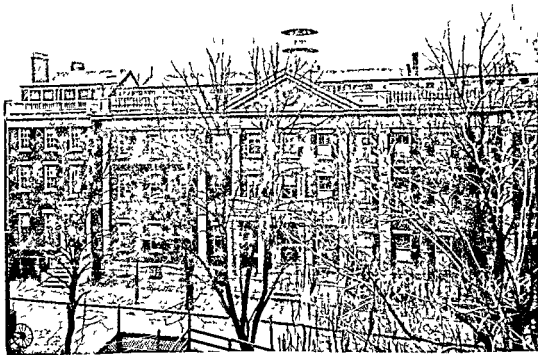
The Gynecological Department is distinct from the surgical services; it controls 60 beds and has two operating rooms for its own use.

The City Hospital is affiliated for teaching purposes with the Harvard Medical School and with Tufts College Medical School. The students work both in the out-patient department and in the house.

BOSTON LYING-IN HOSPITAL

The Boston Lying-in Hospital was established in 1833 and reopened in 1873 in the buildings which it now occupies. It embraces the length of McLean Street, No. 4 being the pregnancy clinic, No. 6 the nurses' home, No. 16 the administration building and No. 24 the hospital itself. During the year 1914, the hospital cared for 789 mothers and 782 babies. The out-patient department attended 1,944 mothers and 1,961 babies.

In 1910 there was organized a pregnancy clinic.



Boston Lying In Hospital



Massachusetts Homeopathic Hospital, the Robert Dawson Evans Memorial Research Building

to care for those women intending to enter the hospital or its out patient department. The hospital was a pioneer in initiating institutional systematic medical supervision of pregnancy and the benefits have been educational and far reaching. The number of patients entering this clinic during 1914 was 1,799, who made a total of 4,562 visits. Of these patients 1,487 were delivered in the hospital or the out-patient department and 1,418 were discharged as well. The chief object of the pregnancy clinic has been not alone the prevention, early detection, and amelioration of the various complications of pregnancy, but to promote maternal general good health that mothers may go to full term, bear living children and suckle them at least during their early months.

The Training School for Nurses was formally established in 1888. Since that date 535 nurses have been given diplomas by the hospital, the latest graduating class numbering 35. The school is so arranged as to admit for different

terms both those who have graduated from the training schools of approved general hospitals and others who have had less hospital or other experience in nursing.

To meet the demands for increased room and equipment land has been purchased on the corner of Avenue Louis Pasteur and Longwood Avenue, opposite the Harvard Medical School, looking toward the erection of a new and larger hospital with out-patient department branches in the north and west ends of the city. Such a hospital, to meet present enlightened opinion, providing all the modern facilities for the care of women in labor and making provision for the medical and surgical care of all the complications of pregnancy and early infancy, and of the infections, injuries, and neoplasms incident to childbearing, will maintain a woman's clinic at least equalling institutions such as the Dublin Rotunda, the infirmaries of Edinburgh or Glasgow and the Frauenkliniken of Dresden and other German cities.



Massachusetts Homeopathic Hospital Main Building

MASSACHUSETTS HOMEOPATHIC HOSPITAL

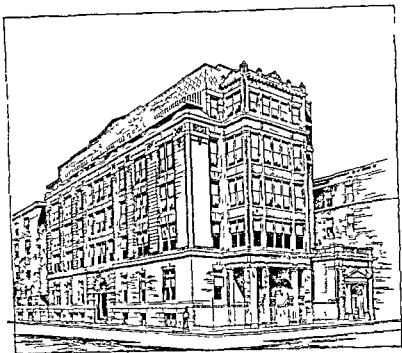
The main part of the Massachusetts Homeopathic Hospital is located on East Concord Street, between Harrison Avenue and Albany Street, on land adjoining the Boston City Hospital. It was incorporated by act of the state legislature in 1855, but it was not opened for the reception of patients until 1871 when it occupied modest quarters at 14 Burroughs Place, its capacity at that time being 16 beds. In 1871 it was moved to East Concord Street, its present location, where it had one building with wards capable of caring for 40 patients. Steadily with the passing years it has increased in size by the addition of wings, annexes, and new buildings, until at the present time its capacity is in excess of 450 beds. The hospital has from the first been supported by private subscriptions, endowment funds and receipts from paying patients, although in 1890, for the purpose of building a medical wing and a surgical annex, it received an appropriation from the state. Its total running expenses during the year 1914 reached the sum of \$251,145 00, and its holdings including real estate and endowments amounted to about \$2,500,000 00.

The hospital in its entirety consists of a main group of buildings wherein are treated medical,

surgical, obstetrical, orthopedic, nose and throat, and eye and ear cases, the equipment including also facilities for up-to-date X-ray work and electro-therapeutics, of the Evans Memorial Department for Preventive Medicine and Clinical Research with its special laboratories, clinical and educational facilities, of the new and enlarged maternity and out patient department now under construction, of the Nurses' Home, and of the special building known as the Clark Ward for Children. In addition the John C. Haynes Memorial for Contagious Diseases is located in Brighton, a home for convalescent women and children in Watertown, and one for convalescent men in Dorchester.

In the hospital there were treated during the year 1914 a total of 7,327 in patients, as against 2,284 in 1900, 683 in 1890, and 190 in 1880, and more than 12,000 out patients were treated during the year just passed. A total of 3,147 operations were performed in the surgical department, 919 of which were abdominal. There were 1,050 confinement cases in the maternity department, with 31 caesarean sections.

The routine pathological work is done in the laboratories of the adjoining Boston University School of Medicine, and included in 1914, 721 tissue examinations and 5,898 "clinical examinations" besides thousands of urinary analyses.



Massachusetts Homeopathic Hospital, the New Maternity and Out Patient Building

The services of ten internes are utilized. Each forenoon, throughout the school year, the wards and operating-rooms of the hospital are open to the senior students of Boston University School of Medicine for clinical training and experience.

BOSTON DISPENSARY

The Boston Dispensary was established in 1796, when Boston had a population of 20,000. During the first year it cared for eighty patients, last year for about 40,000. It provides medical care for the sick in the following ways:

1. Out patient clinics at 25 Bennet Street, receive approximately 110,000 visits annually from over 30,000 patients. Twelve clinical departments, including clinics in general medicine for adults and for children, clinics in surgery, and in all the recognized specialties, are included in the dispensary. All clinics are open during the morning at the same time, so that special opportunities are provided for team-work in diagnosis, involving as it often does personal consultation among departments. Instruction is given to students of the Harvard Medical School and the Tufts College Medical School, and various courses for graduates in medicine are offered by members

of the staff who are connected with Harvard Graduate School. Patients unable to afford adequate medical service are admitted to the morning clinics on the payment of nominal fees, usually 10 cents or when necessary, as is often the case, without charge.

2. Certain clinics have been established in the evening to meet the need of working people who can not attend clinics in the daytime without loss of wages. At these evening clinics a charge of 50 cents a visit is made. The medical service is salaried. Evening clinics include at present, departments for eye diseases (men and women), genito-urinary diseases (men only), and syphilis (men and women).

3. District physicians are sent to treat acutely sick patients in their homes throughout the city of Boston. No service of this character is provided by the municipality, the Boston Dispensary having furnished it since its foundation. About 8,000 patients are cared for annually, nursing service being provided by the Instructive District Nursing Association of Boston.

4. The Hospital for Children, with twenty-five beds, supplements the unusually large children's service of the dispensary, which includes twelve to fifteen thousand individual patients a year. A



Boston Dispensary

system of following-up patients for the double purpose of providing needed care after discharge from the ward, and for informing the staff as to the results of treatment is maintained

4. Medicine is dispensed by the pharmacy which is open every day in the year, furnishing 93,000 prescriptions during 1914

5. A Social Service Department, including eleven salaried workers, a number of students, and many volunteers, assists the medical staff in the out-patient clinics and in the Hospital for Children in making treatment effective when disease is complicated by social problems such as poverty or ignorance. Through affiliation with the Boston School for Social Workers students are given a systematic course of training leading to a diploma in medical social service.

6. The study of standards and methods of dispensary service is systematically pursued by members of the medical and executive staffs of the Boston Dispensary, including studies of the medical results of out-patient treatment in various diseases and modes for testing the efficiency of hospital and dispensary service

7. Publications. The annual reports of the Boston Dispensary in which much space is devoted to study of methods and results are sent to any address on request without charge. A series of articles has been issued, dealing with various phases of the standards, methods, and

results of out-patient service, which is likely to be of interest to medical staffs, administrators, or trustees of hospitals and dispensaries. Lists of these publications are furnished free on request and the publications themselves at cost price.

BOSTON STATE HOSPITAL

This institution, conducted by the state, is for the care and treatment of the insane from the city of Boston. All classes of mental cases are received. The present capacity is 1,450 beds. The medical staff numbers seven, exclusive of the superintendent and the pathologist. There are 203 nurses and attendants, the employees numbering 329. A training school for nurses is maintained, also a social service department.

The hospital was established by the city on another site in 1839, it was moved to the present location in 1893-95, and was taken over by the state in 1908 since which date buildings have been added doubling its capacity. The site, 232 acres, is partly in Dorchester and partly in West Roxbury District, bounded by Austin, Canterbury, Walk Hill, and Harvard Streets and bisected by Morton Street, on either side of which lie the East and West Groups, the former a reception and treatment division, the latter devoted to custodial and infirmary care.

The institution is in plan a combination of the cottage and segregated pavilion types—



House of the Good Samaritan

separate buildings of varying size and disposition for the different classes of patients. Non restraint, much open air freedom and industrial training are features of the management.

HOUSE OF THE GOOD SAMARITAN

The House of the Good Samaritan, located at the corner of Francis and Binney streets, is under the government of the association of the same name, and was incorporated in 1860.

Free care and medical treatment are given to white women and girls over two years of age, children from two to twelve with orthopedic diseases are also taken. The total number of beds is 64, divided as follows: 14 for chronic medical cases (paralysis not taken), 17 for pulmonary tuberculosis, 21 for cancer and 12 for orthopedic.

Patients are taken irrespective of creed or nationality.

LONG ISLAND HOSPITAL

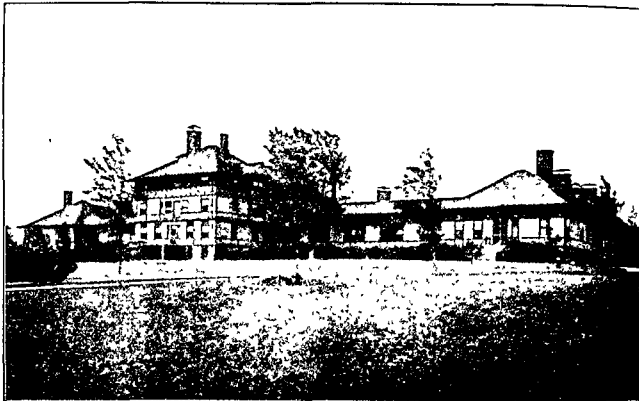
The Long Island Hospital is situated in Boston Harbor, about five miles from the center of the

city. It is a large general hospital of 400 beds with an isolated unit of 60 beds for segregating tubercular patients, and has two infirmaries with additional beds to accommodate 600, also a registered maternity hospital and nursery with usually 40 or 50 children. Four pavilions are now being erected with a capacity of 104 beds for the better segregation of patients.

The hospital offers exceptional clinical facilities in neurological, skin, venereal, and chronic diseases. A training school comprising 60 pupils is maintained in connection with the hospital, offering a two years' course of instruction.

MASSACHUSETTS CHARITABLE EYE AND EAR INFIRMARY

The Massachusetts Charitable Eye and Ear Infirmary was incorporated in 1827 for the purpose of gratuitously treating diseases of the eye and ear. It is thus the second oldest hospital in New England, and with its ward capacity of 215 beds, its large out patient clinic and its special building for the treatment of contagious



Long Island Hospital

ophthalmia, the largest hospital of its kind in the world.

The work of the out-patient department is carried on during the morning, with an average daily attendance of about two hundred patients, representing all the common occupations and coming from all over New England. The same staff attends these patients and the ward patients, thus securing a maximum of efficiency without unnecessary duplication of work in diagnosis and preliminary study. Nearly all the ward cases are admitted through the out-patient department and return there for further treat-

ment after leaving the wards, so that the whole work of the hospital as carried on is directed to the complete and continuous treatment of each patient by the same group of surgeons.

In the wards 3,652 patients were treated last year, including 278 contagious cases treated in the Gardner wards, of whom 115 were infants. There were 3,287 operations in the out-patient department and 2,713 in the house.

All of the clinical work is carried on in the mornings and is so organized as to afford opportunity to visiting surgeons for observing its nature and scope.

PRELIMINARY CLINICAL PROGRAM FOR BOSTON MEETING

MASSACHUSETTS GENERAL HOSPITAL

Monday

- C. A. PORTER—9 Operations Goiter, cancer of stomach
 D. F. JONES—9 Operations Cancer of rectum (first stage)
 R. C. CABOT, HUGH CABOT, and OSCAR RICHARDSON—10 Demonstration Comparison of clinical evidence with post mortem findings
 HUGH CABOT et al.—2 Operations Epididymectomy for tuberculosis, litholapaxy for stone in bladder, ureterotomy for stone
 C. L. SCUDDER—3 Demonstration Fractures
 HUGH WILLIAMS—3 Demonstration Cases

Tuesday

- E. G. BRACKETT and R. B. OSGOOD—9 Operations Excision of knee, with bone plates, exploration of knee joint through median incision
 D. L. EDGALL—10 Clinic Border line cases
 C. L. SCUDDER and H. F. HEWES—10 Demonstration Diagnosis and treatment of chronic gastric ulcer
 G. W. W. BREWSTER—2 Operations Hysterectomy for fibroids, appendectomy
 LINCOLN DAVIS—2 Operations Ureterotomy for stone, hysterectomy
 ROGER I. LEE and BETH VINCENT—2 Demonstration Splenectomy for pernicious anemia
 C. C. SIMMONS—3 Demonstration Osteomyelitis
 G. A. LFLAND, JR.—3 Demonstration Anthrax

Wednesday

- F. G. BALCH—9 Operations Prostatectomy, abdominal tumor
 R. B. GREENOUGH—9 Operations Benign tumor of breast, cancer of breast
 Z. B. ADAMS, M. S. DANFORTH, and C. H. BLICHOLZ—10 Demonstration Scoliosis
 L. T. BROWN—10 Demonstration Postural defects
 FARRAR COBB—2 Operations Hysterectomy for cancer (Wertheim)
 HUGH WILLIAMS—2 Operations Gall bladder
 R. C. CABOT, HUGH CABOT, and OSCAR RICHARDSON—3 Demonstration Comparison of clinical evidence with post mortem findings

Thursday

- HUGH CABOT et al.—9 Operations Nephrectomy for tuberculosis, pyelotomy for stone, prostatectomy
 R. C. CABOT—10 Clinic Border line cases
 AMNER POST—10 Demonstration Congenital syphilis
 L. G. BRACKETT and R. B. OSGOOD—2 Operations Open operation on hip, gig saw osteotomy of knee joint
 C. A. PORTER, A. K. STONE, H. F. HEWES, and J. B. HARTWELL—3 Demonstration Tuberculous cervical adenitis
 W. J. MIXTER—3 Demonstration Fracture of the skull

Friday

- C. L. SCUDDER—9 Operations Duodenal ulcer, cancer of stomach, fracture of femur
 R. B. GREENOUGH—9 Operations Cancer of jaw, tongue, or lip

- J. C. WARREN—10 Demonstrations Reminiscences of the discovery of ether
 C. A. PORTER—10 Demonstration Cases
 R. H. MILLER—10 Demonstration Tetanus
 C. A. PORTER—2 Operations Tuberculous cervical adenitis, operation on peripheral nerve
 D. F. JONES—2 Operations Cancer of rectum (second stage)

Surgical Specialties

- A. COOLIDGE, J. P. CLARK, H. P. MOSHIER, D. C. GREENE, W. F. KNOWLES, H. A. BARNES, C. ROBBINS, and F. E. GARLAND—Fye, ear, nose, and throat clinics, daily
 G. H. WRIGHT—Demonstrations in oral surgery
 J. L. GOODALE—Demonstration The diagnosis and desensitizing of hay fever

BOSTON CITY HOSPITAL

Monday

- J. B. BLAKE, W. E. FAULKNER, and L. R. G. CRANDON—9 Operations Surgical
 F. S. NEWELL, E. B. YOUNG, and N. R. MASON—2 Operations Gynecological
 G. P. SANBORN—3 Demonstration End results in the tuberculin treatment of lymphnodular tuberculosis
 F. W. WHITE, F. B. LUND, and R. D. LEONARD—4 Demonstration Diagnosis and treatment of ulcer and cancer of the stomach (medical, surgical, X-ray)

Tuesday

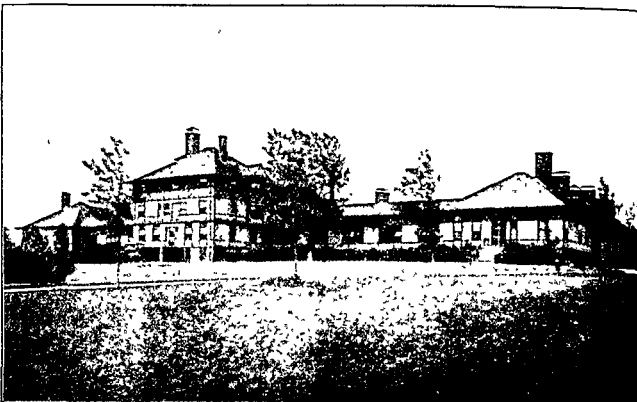
- F. B. LUND, F. J. COTTON, and D. D. SCANNELL—9 Operations Surgical
 PAUL THORNDIKE and assistants—2 Operations Genito urinary
 PAUL THORNDIKE—3 Demonstration Prostatectomy, renal calculus
 HORACE BINNEY—4 Demonstration Treatment of tumors of the bladder with the high frequency current

Wednesday

- L. H. NICHOLS, H. A. LOTHROP, and J. C. HUBBARD—9 Operations Surgical
 J. B. BLAKE, W. E. FAULKNER, and L. R. G. CRANDON—2 Operations Surgical
 J. B. BLAKE—3 Demonstration Splenectomy for Banti's disease
 A. R. KIMPTON—4 Demonstration Transfusion by the use of glass cylinders, bone tumors, resection of the stomach for sarcoma

Thursday

- PAUL THORNDIKE and assistants—9 Operations Surgical
 F. B. LUND, F. J. COTTON, and D. D. SCANNELL—2 Operations Surgical
 F. J. COTTON—3 Demonstration Artificial impactions in fracture of the hip, joint affections, separations of the lower epiphysis of the femur
 F. B. LUND—4 Demonstration Results of operative treatment of fractures, particularly with Farham and Martin bands



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 R H MILLER—10 Demonstration Tetanus
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 D F JONES—2 Operations Cancer of rectum (second stage)

Surgical Specialties

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 G H WRIGHT—Demonstrations in oral surgery
 J L GOODALE—Demonstration The diagnosis and desensitizing of hay fever

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 F B LUND—4 Demonstration Results of operative treatment of fractures, particularly with Parham and Martin bands

J H CUNNINGHAM—4 30 Demonstration Congenital cystic kidney, results of operations for intestinal tuberculosis, nephrectomy for acute unilateral hematuria, togenous infections of the kidney

F H LAEVE—5 Demonstration Cardiospasm, carcinoma of the jejunum, resection of the rectum with perineal anus

Friday

F S NEWELL, E B YOUNG, and N R MASON—9 Operations Gynecological

E H NICHOLS, H A LOTHROP, and J C HUBBARD—2 Operations Surgical

E H NICHOLS—3 Demonstration Results and methods of operating for osteomyelitis, cerebral surgery

H A LOTHROP—4 Demonstration A new operation on the frontal sinus

J C HUBBARD—5 Demonstration Sarcoma of the femur, excision of the transverse colon, perforation of duodenal ulcer, transverse duodenal removal of a gallstone, rupture of the liver

In connection with the operative clinics, demonstrations of special methods of anesthesia—intratracheal, spinal, etc.—will be given, where possible, by J E. BUTLER, F L RICHARDSON, and N N MORSE

CHILDREN'S HOSPITAL

Orthopedic Department

R W LOVETT, A THORNDIKE, ROBERT SOUTTER, A ECKENFRIED A T LEGG, J W SEVER, and HENRY J FITZSIMMONS—Daily, 9 to 11 Orthopedic operations Reduction of congenital dislocation of the hip by various methods, and especially by a special machine, tendon transplantations, capsule reeling etc., in infantile paralysis the use of silk ligaments in infantile paralysis, the operative correction of club foot, the Hibbs and Albee operations for tuberculosis of the spine, the operative treatment for spastic paralysis, operations for coxa vara, bone transplantations

R W LOVETT—Monday, 2 30 and 5 10 Demonstration The treatment of infantile paralysis by muscle training, with exhibition of patients The treatment of scoliosis by forcible jackets Application of jackets and demonstration of results

ROBERT SOUTTER and A T LEGG—Monday 3 15 Demonstration Exhibition of the results of the operative treatment of infantile paralysis

E G MARTIN—Monday 3 30 Demonstration An apparatus to determine the strength of muscles affected by infantile paralysis with conclusions to be drawn from observations made by it

J J THOMAS and J W SEVER—Monday 4 Demonstration Obstetrical paralysis and fracture of the acromion process simulating it

Monday, Tuesday, and Wednesday, 3 Demonstration Treatment of paralysis by muscle training

A THORNDIKE—Monday, 4 30 Demonstration End results in osteoplastic operation for spinal tuberculosis

PERCY BROWN—Monday, 4 50 Demonstration Röntgen results in osteoplastic spinal operation

Thursday, 4 Demonstration Result of röntgen investigation in cases of fibrous stenosis of the pylorus in children Daily, 10 to 4 Exhibition of röntgenograms, röntgen department

ROBERT SOUTTER—Thursday, 3 Operation A new operation for flexion contraction of the thigh in infantile paralysis

A T LEGG—Thursday, 3 30 Operation Transplantation of the origin of the pectoralis major muscle in paralysis of the shoulder

A FRIEDRICH—Thursday, 2 30 Demonstration Multiple enchondroma

H J FITZSIMMONS—Monday, Tuesday, and Wednesday, 3 Demonstration Treatment of scoliosis with methods in use, cases and records

Thursday, 4 20 Demonstration Apparatus for reduction of congenital hip dislocations

PROFS ERNST, POLIN, HUNT, CANNON, and WOLBACH, DRs STONE and MORSE—Thursday, 4 30 Clinic Infantile paralysis

Visit to orthopedic wards daily, 11 to 12 The new hospital buildings will be open to inspection by visitors daily, 9 to 10

Surgical Department

J S STONE, W E LADD, C G MIXTER, and T W HAWKES—Daily, 11 to 1 Surgical operations Harelip, cleft palate, empyema, hernia, cervical adenitis webbed fingers hypospadias, undescended testis, etc

C G MIXTER—Tuesday, 2 30 Demonstration Imperfect and ectopic anus

Wednesday, 2 30 Demonstration Tuberculous peritonitis, pyloric stenosis, undescended testis

W L LADD—Tuesday, 2 30 Demonstration Cervical adenitis

Wednesday, 2 30 Demonstration Intussusception, harelip and cleft palate

J S STONE, W E LADD, and J J THOMAS—Tuesday, 2 30 Demonstration Fractures in children, subperiosteal and epiphyseal, elbow joint fractures, Volkmann's ischemic contractures

J S STONE—Wednesday, 2 30 Demonstration Some obscure abdominal conditions, empyema, harelip, and cleft palate, acute epiphyseal lesions

T W HAWKES—Wednesday, 2 30 Demonstration The treatment of birthmarks

PROFS ERNST, POLIN, HUNT, CANNON, WOLBACH, DRs LOVETT, STONE, and MORSE—Tuesday, 4 30 Clinic Cervical adenitis

DRs CROSBY, GREENE and F E GARLAND, three after noons Eye, ear, nose, and throat clinic

Visit to general surgical wards daily 10 to 11

MASSACHUSETTS HOMOEOPATHIC HOSPITAL

Monday

A G HOWARD and H MOORE—9 Orthopedic operations Bone grafting, tendon transplantation

J H PAYNE and D W WELLS—9 Eye operations Advancement pulley suture, advancement, modified Worth, ptosis, tarsal operations, trephining, glaucoma

DRs RICE HOLGHTON and C SMITH—2 Operations Nose and throat

W F WESSLEHOFT and T F CHANDLER—2 General surgical operations Gastric ulcer, ventral hernia, inguinal hernia, appendicitis, oesophageal diverticulum

Tuesday

J I BRIGGS and C T HOWARD—9 General surgical operations Prostate appendix, goiter, inguinal hernia

G A SUFFA and A W HURR—9 Eye operations Muscle tucking advancement, modified Worth, cataract extraction glaucoma

- HORACE PACKARD and C T HOWARD — 2 General surgical operation Appendectomy, a simpler method of sealing the appendicular stump Demonstration cases Prostatectomy, the choice of routes, the control of post-operative hemorrhage, illustrative operations, emphysema, cases for demonstration, enteroptosis, cholelithiasis
- DRS RICE, HOLCOTTON, and SMITH — 2 Operations Nose and throat

Wednesday

- DRS RICE, HOLCOTTON, JOHNSON, SMITH, and BUSH — 9 Operations Nose and throat
- GEORGE H FARL and H MOORE — 9 Orthopedic operations Congenital dislocation of the hip, bone grafting, tendon transplantation
- W F WESSELHOFF and R C WIGGINS — 2 General surgical operations Nephrolithiasis
- I W COLBURN — 2 Operations Ear

Thursday

- J L BRIGGS and C CRANE — 9 General surgical operations Cancer of the breast, appendix, cholelithiasis nephrolithiasis
- DRS RICE, HOLCOTTON, and C SMITH — 9 Operations Nose and throat
- G R SOUTHWICK — 2 Gynecological operations Ovarian cystomata retrodisplacement of uterus, uterine fibromata, perineorrhaphy

Friday

- G R SOUTHWICK and D G WILCOX — 9 Gynecological operations
- DRS A S BRIGGS, BOYD LEE, SEDGELEY, SOUTHER, and THOMAS — 2 General surgical operations

Demonstrations

- W H WATERS — Surgical pathology
- G A SUTTA — Ophthalmotropes
- Routine examination of ante partem cases — Wednesday, 10
- Social service clinic for post partem cases — Thursday, 2
- Daily clinics in twilight sleep
- Daily exhibition of new maternity building

PETER BENT BRIGHAM HOSPITAL

- HARVEY CUSHING — Daily Clinics or demonstrations Surgery of the brain, pituitary body spinal cord, peripheral nerves
- DAVID CURRIER and JOHN HOMANS — Daily Operations Surgical
- HENRY A CHRISTIAN CHANNING FROTHINGHAM, and others of the medical staff will cooperate in giving clinics or demonstrations on selected topics, such as the electrocardiogram etc

LILL HOSPITAL FOR WOMEN

- DRS GRAVES, FEMBERTON WADSWORTH, HUTCHINS and BAKER — Tuesday, Wednesday, and Thursday, 9 Operations Gynecological
- DR FEMBERTON — Wednesday, 2 30 Cystoscopic demonstration
- DR HUTCHINS — Thursday, 2 30 Demonstrations Laboratory specimens

ST ELIZABETH'S HOSPITAL

- DRS LANE and SUPPLY — Monday and Thursday, 9 Operations
- DR M J CROVIN — Monday, Thursday, and Friday, 10 Ward visit
- Wednesday, 9 Intravenous salvarsan injections
- DR T I BRODRICK — Tuesday, 9 Orthopedic operations and clinic
- DR A L CUTTE — Wednesday and Friday, 9 Operations Genito-urinary
- DRS BRAINER and HOLMS — Tuesday, 9 Nose and throat clinic
- DR A F DOWNING — Monday and Friday, 11 Demonstrations Laboratory technique
- DR P I BUTLER — Tuesday and Thursday, 10 Demonstration Radiography
- DRS McDONALD and McADAMS — Wednesday, 10 Eye clinic

The history, diagnosis, and indication for operation in each case will be discussed previous to operation by Dr Cronin of the medical service and Dr Butler of the roentgenological department

ROBERT BRIGHAM HOSPITAL

- CHARLES I PAINTER, EDWARD RICHARDSON, LLOYD T BROWN, and RICHARD MILLER — Tuesday and Thursday — 10 Operations
- Monday, Wednesday, and Friday, 3 Clinics Surgery of chronic diseases arthritis, intestinal tuberculosis, peritoneal adhesions, hemolytic diseases

NEW ENGLAND HOSPITAL FOR WOMEN AND CHILDREN

- MARY A SMITH and ABBY M O'KEEFE — Monday and Thursday, 10 Operations Gynecological
- ELIZABETH T GRAY and LETITIA D ADAMS — Monday, 2, Tuesday, 10 Operations Gynecological
- EMMA B CLIFPERTSON and GLADYS COOPER — Tuesday and Friday, 2 Operations Gynecological
- FLORENCE DUCKERING and LETITIA D ADAMS — Wednesday, 10
- Thursday, 2 Operations Gynecological
- MAUDE CARVILL — Thursday, 2 Eye clinic
- MARGARET NOYES — Wednesday 2 Ear, nose, and throat clinic
- ISABELLE D KERR — Friday 10 Ear, nose, and throat clinic
- Scopolamine morphia anesthesia both with and without ether will be used during these clinics Statistics, covering six years continuous use of this form of surgical anesthesia, on over 1,400 cases are available Dr Abby M O'Keefe, professional anesthetist, has entire charge of this department

LONG ISLAND HOSPITAL

- F H LAHEY — Monday 2 Operations
- J H CUNNINGHAM — Tuesday and Wednesday, 2, Operations
- ROBERT SCUTTER — Thursday and Friday 2 Operations

CARNEY HOSPITAL

- J T BOTTOMLEY and D F MAHONEY — Monday, Wednesday, and Friday 9 Operations Surgical
- W R MACLESLAND and A K MACLESLAND — Monday, Wednesday, and Friday, 9 Operations Orthopedic
- I W JOHNSON and S RICHMOND — Tuesday and Thursday 9 Operations Gynecological

CODMAN HOSPITAL

E A CODMAN—Tuesday, 10 Operations Surgical
 Demonstration of lesions about shoulder joint
 Thursday, 10 Operations Surgical Demonstration
 of lesions of duodenum

HOUSE OF THE GOOD SAMARITAN

DRS SOUTTER, LEGG, and SEVER—Monday, Wednesday,
 and Friday, 10 Clinics Infantile paralysis, muscle
 transplantation, flattened condition of the head of
 the femur, obstetrical paralysis

TUFTS MEDICAL SCHOOL

A W. GEORGE—Daily, 2 to 5 Demonstrations Ront-
 genology.

MASSACHUSETTS CHARITABLE EYE AND EAR
INFIRMARY

DRS CROCKETT, MOSHER, and EMERSON—Monday and
 Friday Otolological clinic

DRS JACK, WALKER, POWERS, and BLODGETT—Tues-
 day Otolological clinic

DRS HAMMOND, WHITE, and FAUCE—Wednesday
 Otolological clinic

DRS JACK, KNOWLES, TOBEY, and BOGAN—Thursday
 Otolological clinic

Eye clinic daily from 9 to 12 Various operations on
 lids, tear sac, and muscles of the eye Different types of
 operation for cataract and glaucoma Magnet operations
 for the removal of foreign bodies from the eye Different
 methods of using local anæsthesia Tuberculosis of the
 eye Interstitial keratitis of specific origin Ophthalmia
 neonatorum and gonorrheal ophthalmia in adults Local
 ization of foreign bodies in the eye by the X ray Demon-
 stration of ophthalmometer for measuring astigmatism of
 the lens Demonstration of lantern slides by pathological
 department

BOSTON DISPENSARY

H M CHASE and H F DAY—Surgical clinic

JOHN ADAMS—Orthopedic clinic

HENRY J PFERRY and ARTHUR H CROSBY—Genito-
 urinary clinic

FORSYTHE DENTAL INFIRMARY

FRED B LEAD—Monday, 9 Surgical operations

HARRY H GERMAIN—Tuesday, 9 Surgical operations

HUGH WILLIAMS—Wednesday, 9 Surgical operations

HUGH CABOT—Thursday, 9 Surgical operations

WILLIAM E CHENEY and LOUIS ARKIN—Daily, 10

Noise and throat clinic

L M S MINER—Tuesday, 2 Oral surgery

HARRY B SHUMAN—Wednesday, 2 Oral surgery

ALBERT L MIDDLEY—Thursday, 2 Oral surgery

DR SROUT—Friday, 2 Oral surgery

ALBERT KENLEY, JR—Daily, 11 and 2 Radiography

WILLIAM A GOSIE—Daily, 11 and 2 Extracting clinic

WILLIAM Z HILL—Daily, 9 and 2 Operative dental
 clinics

FRANK A DELABARRE—Daily, 9 Orthodontia clinic

Research Laboratory will be open from 9 to 12 and 2
 to 4 daily Exhibition of pathological and bacteriological
 specimens

HARVARD MEDICAL SCHOOL

PROFS COUNCILMAN and MALLORY—Demonstration
 Pathology

PROFS CANNON and W T PORTER—Demonstration
 Physiology

PROF FOLIN—Demonstration Chemistry

PROF STRONG—Demonstration Tropical Medicine

PROF REID HUNT—Demonstration Pharmacology

DRS ORDWAY and TYZZER—Demonstration Cancer
 research

JOHN WARREN—Demonstration Anatomy

W F WHITNEY—Demonstration Warren anatomical
 museum

F T LEWIS—Demonstration Embryology

J E GOLDTHWAIT—Demonstration Visceroptosis

SURGERY, GYNECOLOGY AND OBSTETRICS

AN INTERNATIONAL MAGAZINE, PUBLISHED MONTHLY

VOLUME XXI

OCTOBER, 1915

NUMBER 4

A SYMPOSIUM ON RENAL INFECTIONS¹

HUGH CABOT, M.D. F.A.C.S.
GEORGE GRAY WARD JR. M.D. F.A.C.S.
J. BENTLEY SQUIER, M.D., F.A.C.S.

FRED J. TALSSIG, M.D. F.A.C.S.
ARTHUR H. CURTIS, M.D. F.A.C.S.
ARTHUR L. CHUTE, M.D., F.A.C.S.

ERRORS IN DIAGNOSIS OF RENAL AND URETERAL CALCULUS

By HUGH CABOT, M.D., F.A.C.S., BOSTON

Assistant Professor Genito-Urinary Surgery, Harvard Medical School, Chief of Genito-Urinary Department, Massachusetts General Hospital

ANY attempt to estimate the nature or frequency of errors in the diagnosis of stone in the kidney and ureter is handicapped at the outset by the well known fact that only a small proportion of the errors are either entered upon the record or reported. We may, therefore, take it for granted that in any review of cases such as I am about to undertake we shall grossly underestimate the frequency of error, though we are more likely to approximate the various kinds of traps set for the unwary.

In a recently undertaken study of 153 cases of stone in the kidney and ureter at the Massachusetts General Hospital, it was noted that 26 abdominal operations had been done upon these patients without relief of the symptoms, which were clearly due to the overlooked calculus in kidney or ureter. The appendix was the most frequent sufferer and was removed in 10 cases, without benefit. What are described as exploratory laparotomies came next in frequency, with 8 cases. Fixations of a kidney supposed to be movable and producing symptoms followed in order with 4. Then came removal of tube and ovary, unsuccessful search for gall-stones, an

attempt to relieve adhesions which did not exist, stripping of the capsule of the kidney for nephralgia, and, as a crowning iniquity, suprapubic cystotomy on a normal bladder for a stone which was situated some two feet away. Each of these monumental blunders has one representative.

Since these errors occurred in the hands of reasonably competent surgeons, it is interesting to discover what symptoms led to the false conclusion. In a study of this group of cases, it appears that in 12 pain in the right lower quadrant constituted what may be called the presenting symptom, the one for which the patient had sought advice and finally came to the hospital. Abdominal pain entirely without colic was the presenting symptom in 13, while backache was the chief complaint in 11. In all this group of 35 cases, the pain was never such as to suggest stone in the kidney and could readily have been mistaken for that associated with disease of abdominal viscera. If, therefore, pain is relied upon as important evidence of stone it is likely to be highly misleading.

It has been generally believed that such errors could be avoided by the routine ex-

¹ Papers presented at the joint session of the American Gynecological Society and the American Association of Genito-Urinary Surgeons, White Sulphur Springs, West Virginia, May 18-20, 1915.

amination of the urine, and that only in a small proportion of cases would stone in the kidney, producing pain over a considerable period of time, be associated with a normal urine. Upon this point our study is illuminating. In 150 cases in which the urine was carefully examined on more than one occasion, there were 21 in which the urine was entirely normal, so that in 14 per cent of the cases reliance could not be placed upon this evidence. It further appeared that the probability of a normal urine was much greater with stone in the ureter than with stone in the kidney. Thus in the 21 cases of normal urine, 15 were cases of stone in the ureter and 6 cases of stone in the kidney. It is, of course, particularly in cases of stone in the right ureter that the diagnosis of appendicitis is likely to be made.

Much reliance has been placed upon the X-ray in cases of abdominal pain of an obscure type, and it is interesting to inquire how frequently the X-ray fails to detect stone. In 127 cases in which satisfactory X-rays were obtained, 8 were entirely and persistently negative which represents a failure of 6 per cent. This is I believe considerably short of the real percentage of failure, because in many of these cases X-rays were repeatedly taken over a period of weeks or months, and if a positive plate was finally obtained, sight of the negative ones is entirely lost. I am inclined to think that 15 per cent is nearer the percentage of failures even in the hands of thoroughly expert radiologists.

From this it appears that we cannot rely upon the character of the pain, the abnormality of the urine, or the positive evidence of the X-ray to lead us with certainty to diagnosis. Further analysis of the cases, however, shows that in this rather small group there was no one in which all these three suggestive symptoms or signs were absent at the same time, and I believe that it would be fairly safe to assume that the absence of characteristic colic, a normal urine and a negative X-ray is a combination of extreme rarity.

There was another group of wrong diagnoses which should be credited to the physician rather than to the surgeon. These included ulcer of the stomach, lumbago, sacro-iliac

strain, acute and chronic Bright's disease, chronic cystitis, and neurasthenia. In support of these errors the following mitigating facts may be noted:

Pain referred to the stomach and vomiting was the chief complaint in 3 cases in the series of 153, sacro-iliac pain and pain called lumbago was the important symptom in 3 cases, while pain referred to the bladder, without other symptoms, was present in 7.

There are a considerable number of cases though I have no accurate figures, in which abnormal urine is the only abnormality to be found. In these a diagnosis of Bright's disease is distressingly common, apparently predicated upon the fact that the urine contains albumin and either pus or blood. It seems almost superfluous to point out that there is nothing about these patients other than the urine to suggest Bright's disease, and that such a diagnosis could not be made by a physician who recognized the fact that chronic nephritis is a disease which affects the cardiovascular system as well as the kidney.

We see every year with our colleagues in the Orthopedic Department a considerable number of cases with pain referred to the region of the sacro-iliac joint, and of these a considerable number prove to have stone in kidney or ureter. Error here can almost invariably be avoided by an examination of the urine and a careful examination of the X-ray plates which are usually taken in the course of diagnosis of the orthopedic difficulty.

It should not be necessary at this time to point out to any trained physician that bladder irritability and an abnormal urine may be the sole symptom of stone in the kidney.

The unfortunate patients who are declared neurasthenic have in our series, been those with abdominal pain, negative physical examination and a normal urine. In our series two such patients had stones in the ureter the removal of which cured the neurasthenia.

Having thus reviewed the cases in which a wrong diagnosis of some other disease resulted from the overlooking of stone, I was interested to turn the tables around and look over some 300 records during a period of 10 years

in the Out-Patient Department in which a provisional diagnosis of renal calculus had been made. In this 300, 65 had to be subsequently corrected, as careful further study showed no stone. In these 65 cases in which no stone was found on further study 28 were finally proved to have some of the following conditions: Orthopedic difficulties, including abnormalities of the spine, sacro-iliac joint, and faulty attitude, accounted for 9, disease of the kidney or urinary system was proved in 9, calcified tuberculous glands for 4, gall-stones for 2, and the rest were scattered among pelvic peritonitis, chronic appendicitis, constipation, and neuroses.

To the trained urologist the most interesting man-traps are those set for him by his association with the imaginative radiologist. Of the cases coming to us with symptoms referable to the kidney, and often with more or less typical renal colic, a considerable number are reported as showing shadows in the course of the urinary tract which, according to the temper of our expert brother, are said to be probably calculi or probably not calculi. As far as I can determine the probability depends largely upon whether he has recently been mistaken on the positive or negative side. A burnt child fears the fire, but as the radiologist is situated between two fires he may take refuge in either to the confusion of the urologist. The difficulties of absolutely confirming the diagnosis in presence of doubtful shadows are considerable. Thus, calcified tuberculous glands lying in the mesentery of the large intestine may be in immediate contact with almost any portion of the kidney or upper ureter. They may even go so far as to press upon the ureter and obstruct it. I have knowledge of two cases at least in which a calcified tuberculous gland produced great obstruction of the ureter with dilatation. In one case the gland was situated in the pelvis and in the other in the midlumbar region. That these cases are fortunately rare should be a source of congratulation. Most foreign bodies in the urinary tract may be verified by the use of radiograph catheters and stereoscopic plates. This method will generally enable one to decide that the suspected shadow is at some

distance in front of or behind the kidney or ureter. In the cases where the shadow lies in contact with the ureter catheter, but does not produce obstruction to the catheter, a correct opinion may be arrived at either by demonstrating that the ureter is dilated by the use of an injected radiograph or by the wax-tipped catheter. Neither of these methods, however, will solve the problem in the few cases above referred to in which the passage of the catheter is obstructed by pressure from without. Under such conditions the wisdom of attempting to make an injected radiograph may be doubted, as, should the injecting fluid pass through the stricture under urging from below, it may well fail to return as easily, and in most cases the injected fluid will not pass the stricture. It is probable that in most of such instances operation is indicated, as was the case in the two above referred to, but there are probably some in which, though the passage of a catheter is interfered with, the passage of the urine is not, and therefore operation must be regarded as meddling. Under these circumstances, a decision will have to be made on the evidence of the symptoms. If they suggest ureteral obstruction, if the catheter will not pass and it is not thought wise to force fluid by, operation should be undertaken.

There is a small group of cases which have seemed to me particularly troublesome. It consists of patients who have symptoms suggesting stone in the ureter, a normal urine, a shadow which may be in the lower end of the ureter, and a ureteral orifice into which a catheter will not enter. In two such cases I have fallen into the trap thus neatly constructed. In one I concurred with my colleague, Dr. Smith, in advising operation upon a young man with shadows in the region of which could be catheterized with colic upon both sides, and a normal urine. Operation showed both ureters free from obstruction, and he made a very eventful and stormy convalescence. In the other I repeated the same blunder myself, only the obstruction existed upon but one side and the orifice of the ureter proved to have a stenosis.

That there are many other pitfalls which beset this complicated question I have no doubt, but these are the ones which have been presented to us in the study of this group of cases. At present I am inclined to lay down the following rules as likely to avoid these errors if carefully followed:

1. In all cases of abdominal pain of a chronic or recurring type, in cases of back-ache, lumbar or sacro iliac joint strain and lumbago, careful repeated examinations of the urine, including a microscopic examination of the sediment in all cases whether albumin is present or not, and of a catheter specimen in all female patients, should precede positive diagnosis. In most of these cases in which the symptoms warrant the consideration of operation, X ray plates are essential.

2. The evidence presented by the X ray alone is insufficient to warrant operation in

most cases of stone in the kidney or ureter. Possibility of error by mistaking other foreign bodies should be excluded by the use of the ureter catheter, stereoscopic plates, injected radiograph, or the wax-tipped catheter.

3. In any case in which the symptoms suggest ureteral calculus and a doubtful shadow appears in the X-ray plate, if the ureter cannot be catheterized on repeated attempts or the catheter is arrested at the same point on various occasions, the decision for or against operation must be made upon the apparent gravity of the symptoms.

4. In cases with symptoms suggesting stone in the kidney, with a normal urine, a negative X-ray, and an unobstructed ureter, the wax-tipped catheter will not infrequently lead to a correct diagnosis and will be likely to fail only in the cases in which the stone lies in a dilated calyx and is therefore out of reach of the catheter.

POST-OPERATIVE RENAL INFECTION

By GEORGE GRAY WARD, JR. M.D., F.A.C.S. NEW YORK.

I BELIEVE that many instances of obscure and apparently unaccountable elevations in temperature, with concomitant symptoms of septic absorption occurring late in the course of a post operative convalescence, are cases of renal infection, and that they are much more frequent than we formerly believed. In the majority of cases these renal infections are of hæmatogenous origin, and are due to the colon bacillus.

In 1906, Brewer first described as a distinct entity a type of acute hæmatogenous infection of the kidney which was unilateral and characterized by multiple septic infarcts. Since this publication numerous cases of this type of infection have been reported by a number of observers, and further contributions by Brewer, Cobb, and others have helped to clarify the subject, and have enabled us to classify its variations and to aid our understanding of its pathology and symptomatology.

But the indications for the treatment of the severe types of this disease are by no means well defined. Neither is the question settled

as to whether this type of kidney infection is characterized by being unilateral, as claimed by Brewer. There would seem to be no reason why the infection might not attack both kidneys simultaneously in certain instances, or first one organ and then the other. Thus it might be possible to account for the variations in the results of nephrectomy and nephrotomy or decapsulation. As Kelly and Burnham state, the subject deserves more study and careful recording of cases; hence my excuse for this report.

In studying the reports of cases of this disease, one is struck with the frequency with which it follows some operative procedure. This is not strange when we remember the probable causative factors and the mode of infection. The preponderance of evidence — the result of both clinical and experimental research — tends to prove that the large majority of such renal infections are hæmatogenous in origin, although some cases may be caused by an ascending infection either by way of the peri ureteral lymphatics, or by extension up the lumen of the ureter.

Albarran first demonstrated that pus-producing organisms gaining access to the blood were eliminated through the kidneys and that these organs were not necessarily damaged as a result. Numerous observers have confirmed these results, and have shown further that anything tending to lower the vitality of the kidney would cause the lodgment of the micro organisms in the substance of the organ with resulting infection.

Lannelongue first noticed that some fatal cases of osteomyelitis have an associated septic infection of the kidney, and Israel and Jordan showed that comparatively insignificant local infections, as furuncles, etc., might be the origin of a septic kidney, just as, by metastasis, they may be the cause of a septic joint. Consequently, whenever we have an infection following operation, be it ever so mild or insignificant (as, for instance, a small stitch-abscess in the skin incision), should one or both kidneys happen to be damaged by previous disease such as might be caused by a calculus or some form of nephritis or by anything that produces congestion and prevents free drainage of the organ (as excessive mobility), the kidney may become infected on account of its lowered resistance from the bacteria which are being filtered through it, with the resulting formation of multiple septic infarcts.

Furniss states that in his opinion most of these cases are due to the breaking loose of infected thrombi from the vessels of the wound region and that they find lodgment in the kidney where they develop the infection. The fact that this condition develops some days after the operation and is sudden in onset and that there usually has been some manifestation of post operative infection, points to the correctness of this theory.

The greater frequency of infection of the right kidney is probably due to its greater mobility and its more frequent displacement, the drainage from that organ being less perfect in such cases owing to kinking or looping of the ureter. Cotton reports two cases occurring in floating kidneys which were markedly displaced. The extreme vascularity of the kidney predisposes it to congestion, especially if displaced and thus disturbance in its cir-

ulation interfering with its function is an important predisposing factor in the production of its infection.

The preponderance of cases in females has been noted often, and is due probably to the fact that floating kidney is more common in that sex. Cotton also points out that the operation of decapsulation and drainage not only relieves the infection, but results in fixation of the kidney, and thus corrects the prolapse, which may have been a factor in the etiology.

Baisch states that while other bacteria may be the original factor in the production of the primary infection, they are supplanted by the colon bacillus, or that, if a mixed infection is present, the colon bacillus persists after the others have disappeared.

The common association of this disease with operations upon the intestinal tract, as for appendicitis, may account for the frequency of colon bacillus infections. Anything that causes a lowered resistance of the kidney makes it a suitable soil for the infection which is constantly passing through it by way of the urine, whenever infection is present in some part of the body. Undoubtedly the pyelitis of pregnancy and the puerperum is but a phase of these cases of kidney infection. The condition of pregnancy predisposes to the attack on account of the pressure by the gravid uterus on the blood-vessels and ureters, causing an increased congestion and less perfect drainage of the kidneys; and the ever present colon bacillus in the neighborhood of the parturient canal and the frequency of parturient wounds supplies the primary focus of infection.

There are three types of the infection, depending upon the degree of virulence, and the virulence naturally varies according to the particular organism, the condition of the kidney, and the general bodily resistance of the patient. They are —

- 1 Cases which are mild in character, the patient not being severely ill, which yield to the thorough flushing of the kidneys by the ingestion of water and formaldehyde, and which yield to proper diet and rest.

- 2 Cases in which the kidneys contain numerous septic infarcts, and minute or

microscopic pus foci, which are superficially situated in the cortex of the organ. Decapsulation or incision with drainage usually results in recovery.

3. The fulminating type, which is characterized by a profound toxæmia and which is rapidly fatal unless a nephrectomy is done. Fortunately this type of the disease is usually unilateral.

The staphylococcus and streptococcus infections produce an abscess formation which originates in a terminal vessel in the cortex as a single focus. From this primary focus other portions of the kidney become involved secondarily. As might be expected this type of the disease is the more severe. The colon bacillus produces a diffuse inflammation of the kidney which does not necessarily result in abscess formation or destruction of tissue. The kidney is enlarged, markedly congested, and infarcts are present. Microscopic examination of these areas of kidney tissue may show the cells riddled with colon bacilli. This type of infection is less virulent than the former and is frequently cured without sacrificing the organ.

As Cunningham has pointed out, a careful study of the clinical picture should show which of these two types is being dealt with, as the clinical signs differ in certain respects and each has a definite relation to these two pathological conditions. He states that the symptoms should suggest the pathological process present and that the type of infection should be recognized on inspection of the kidney at the operation. This is extremely important as the form of procedure to be followed depends upon a correct diagnosis of the variety of the infection. Nephrectomy will be necessary in multiple abscess formation, while a nephrotomy or decapsulation with drainage may be sufficient in the milder forms. Nephrectomy is probably resorted to more frequently than is necessary owing to a failure to appreciate the exact pathology. Cunningham states that the chief feature differentiating the mild form of the disease from that of abscess formation is the lesser degree of progressive toxæmia and the presence of more abnormal elements in the urine. He notes that the abscess cases are character-

ized by very slight changes in the urine, contrary to what one would expect. This is because the abscesses, being generally located in the periphery of the organ, find no avenue of escape through the collecting tubules, which are either plugged by the products of inflammation or compressed by the infiltrated tissue surrounding them.

As the less severe type of the disease is usually due to the colon bacillus, the presence of this organism in the urine gives rise to a characteristic appearance. The urine is turbid or cloudy, and remains so on standing. This is due to the motile power of the bacilli which keeps them in constant motion and thus prevents them from sinking to the bottom of the glass as other organisms do, with the exception of the proteus hauseri.

Urine containing the colon bacillus is nearly always of an acid reaction. Marked irritability of the bladder is present, due to the discharge of pus into the bladder. This irritability as manifested by frequency of micturition and dysuria is often an early sign of the onset of the disease, and I believe that many cases where the nurse has been held responsible for a supposed cystitis due to carelessness in using the catheter are really due to a renal infection of hematogenous origin.

In the treatment of mild cases of infection of the kidney the indication for conservatism is not disputable and in the fulminating type with the presence of abscesses we have no choice but a prompt nephrectomy. But the proper treatment of the second type of the infection cannot be so clearly defined. Much depends on the progress of the disease in each individual case and to decide correctly when to operate and when not to operate calls for the exercise of great care and thoroughness in considering all the factors and sound judgment in weighing their relative value. The general principle governing the line of treatment should be that of conservatism coupled with a sharp watchfulness for signs and symptoms indicating that the point of toleration to toxic absorption has been reached by the patient, the result of lowered resistance caused by the progress of the disease.

At the outset palliative measures such as

rest, a simple and unirritating diet, the ingestion of large quantities of pure water, with the employment of urotropin or other urinary antiseptics should be instituted and maintained so long as the resistance of the patient is equal to the task of combating the toxæmia. Should the limit of the patient's ability to resist the disease be approached, as shown by the blood count and a continued high range of temperature and increasing pulse rate with evident progressive loss of strength operative interference is indicated.

It is important in employing urotropin to give a sufficient quantity to insure the presence of formaldehyde in the urine. As has been pointed out by Burnham, it is necessary to test the urine frequently for formaldehyde to be certain that it is being liberated. The usual dosage of five to ten grains three times daily is rarely sufficient, and it should be increased up to twenty or thirty grain doses if necessary to show the drug in the urine. As the antiseptic power of urotropin is not manifested in alkaline or neutral urines, the acidity should be assured by giving acid sodium phosphate.

If operation is necessary, nephrectomy should not be done unless the indications for it, as shown by the appearance of the kidney are positive. A decapsulation or nephrotomy with drainage is sufficient in many cases, as shown by numerous reports, especially in the colon bacillus infections.

Lubenthal was probably the first to do a nephrotomy in a septic kidney. He reported a striking case of bilateral hæmatogenous infection with recovery following a double nephrotomy in 1896.

The following case of a severe colon bacillus infection which evidently first attacked one kidney and then the other, and in which decapsulation with drainage resulted in a complete recovery, is here reported.

Mrs. G. P. aged 42, was referred to me on October 29, 1914, by Dr. Kast under whose care she had been for the previous year for treatment of a gastro-enterological condition, general enteroptosis, and neurasthenia. The patient from time to time had such symptoms as were indicative of fecal stasis in the cæcum and ascending colon with a chronic appendicitis. In view of these recurring attacks of indigestion in spite of dietetic precautions,

and in view of the tenderness in the appendix region an operation was advised to remove the appendix in order to eliminate reflex disturbances which apparently originated from that organ.

Examination showed in addition to the above findings that she had a retroverted uterus of the third degree and a relaxed vaginal outlet.

I operated on October 30, 1914, doing a curettage, a repair of the pelvic floor, shortening of the round ligaments after the Gilliam method, and an appendectomy. The colon was dilated and relaxed, and a well developed Jackson's membrane was present. There was no evidence of a Lane's kink. The appendix was adherent and showed a chronic inflammatory process.

There was nothing unusual in the convalescence during the first week except that the patient suffered more from gas than usual and her temperature did not reach normal after her initial reaction but remained at 100° to 100.5° up to the sixth day. The wound was then dressed and had apparently healed by primary union. On the ninth day she complained of soreness in the lower angle of the incision, and as her temperature had reached 101.5° with a leucocytosis of 20,500 and a polynuclear percentage of 78 the wound was opened just above the symphysis and a considerable quantity of pus was liberated. The laboratory reported a mixed infection.

It was noticed that an irritability of the bladder manifested itself on the fourteenth day, causing her to void five or six times at night, with dysuria. This irritability continued in varying degree throughout the illness. On the evening of the nineteenth day she complained of a severe backache. The abdominal wound was dressed daily, and closed without trouble. On the twentieth day the patient was out of bed for a short while as her temperature had reached normal.

On the twenty first day after the operation her temperature suddenly rose to 103.5° per rectum with a pulse of 120. The next day, the twenty second, she complained of pain in the left lumbar region, and examination showed decided tenderness at the site of the left kidney. There was also extreme irritability of the bladder. This exacerbation continued for five days during which time she was treated with diluents and urotropin. The urine was turbid and acid and contained numerous pus cells, with an abundance of colon bacilli. A blood culture showed no growth. The temperature gradually declined to normal on the sixth and seventh days after the onset of this attack and as the exacerbation was over and as the patient's condition showed marked improvement, a speedy recovery was hoped for although it was explained to the family that these attacks were likely to recur.

On the twenty eighth day a second exacerbation commenced which lasted for six days and was much more severe than the first, the maximum temperature being 104.2° and the pulse 140.

The patient was very drowsy at times and had

rigors, and the picture presented was that of a very sick woman. The left kidney was painful and there was decided tenderness in the left costovertebral angle and rigidity of the upper abdomen. The right side was negative.

Dr. Peck was called in consultation on the sixth day of the second attack, and after a careful study of the case it was felt that an operation was not indicated at that time, although the patient was much prostrated, as the temperature and pulse were declining and it seemed probable the exacerbation was reaching its end. The wisdom of this was apparent during the next three days when the temperature remained normal as has shown by subsequent events. On the third day of this normal period an hour on the sixth sixth day after the operation the patient suddenly developed severe pain in the right iliac region which was aggravated by deep breathing. There was marked tenderness in the right costovertebral angle. Dysuria was also greatly increased. A specimen of urine obtained by Dr. Tarassov from the right kidney had shown the presence of coliform bacilli.

The next day the temperature started to rise and it was evident that she was in for a third attack. By the fourth day the temperature had reached 101.5° per rectum with a pulse of 160 and it was plainly manifest that the patient had reached the limit of her endurance owing to her prolonged illness.

Dr. Ellenthal saw her in consultation and an exploration was made with an aspirating needle but with a negative result. An exploration of the kidney was a failure in spite of this, and the next morning on the fifth day of this third exacerbation I explored the kidney with gas and oxygen anaesthesia. The temperature at the time of operation was 101.2° per rectum and the pulse 150. The peritoneal fat was adherent to the organ and on delivering the kidney it was found to be swollen to nearly twice its normal size. It was markedly congested, being a dark bluish color with mottled areas. The kidney was completely decapsulated, the capsule being adherent, and several infarcts were in evidence, but there were no gross signs of pus present. Minute portions of the infarcts and kidney tissue were removed for examination. Further search showed no evidence of pyelonal or subcapsular pyus pockets. Gauze and rubber tissue drainage was employed. The time of the operation was sixteen minutes and of the anaesthesia twenty minutes.

In twenty-four hours the temperature had dropped to 101.6° and the pulse to 60, and the whole picture showed a marked change for the better. As the patient was so very weak with a hemoglobin below 60 and red cells of but 3,000,000 it was deemed wise to transfuse her in order to increase her resistance and thus facilitate her recovery. Therefore the day following the operation she was given 275 ccm. of blood from a vigorous male donor by the syringe method. This resulted in a decided improvement in the condition and the

patient went on to a normal recovery without further incident.

The temperature reached normal on the sixth day after the decapsulation and the forty-seventh day after the original operation.

The report of the pathologist, Dr. R. W. Taylor, of the Post Graduate Hospital Laboratories on the tissue removed from the kidney was as follows:

December 20, 1914. Three pieces of bright red tissue, each having a volume about that of a spleen. Microscopic examination sections reveal distinctly the structure of the cortical portion of the kidney in which is a marked inflammatory reaction manifested by the diffuse infiltration of enormous numbers of polymorphous leucocytes. All of the recognizable tubules and glomeruli show a marked cloudy swelling and in some areas where the leucocytes are especially numerous they are completely disintegrated.

The leucocytes may be seen beneath Bowman's capsule in the glomeruli within the convoluted tubules and in the intertubular stroma. So extensive and diffuse is the process that it is impossible to say from a histological examination whether it evened its way to the pelvis or was hematogenous in origin. In places the inflammatory cells are so numerous as to suggest small abscess formation, or it would not be surprising if the whole area from which the specimen was taken would necrose. There has also been considerable recent hemorrhage between these tubules.

Stains for bacteria revealed the presence of short gram-negative bacilli which are especially numerous in some of the tubules. Morphologically these bacteria resemble the vibrio bacillus.

Diagnosis: Acute diffuse purulent nephritis with hemorrhage.

This case is typical of the second variety of renal infection previously mentioned in which a virulent septic involvement of the kidney by the colon bacillus produces a diffuse inflammation of the tissues with the formation of infarcts, but which at the time of operation had not produced microscopic abscesses, but in the light of the pathologist's report would probably ultimately have done so.

Undoubtedly this case would have terminated fatally if operation had been longer deferred, yet as the attack on the left kidney subsided without interference it would seem that the delay was justified. The first two exacerbations were apparently confined to the left kidney, as there was no evidence of the involvement of the right kidney until the onset of the third attack, when all tenderness

of the left organ had subsided for several days

The condition of the urine in this case pointed to the type of the disease of the kidney which was found at operation in accord with Cunningham's observation, as there was an abundance of purulent elements constantly present.

The pathological state of the kidney, there being an absence of a gross manifestation of pus, indicated that a nephrectomy was not necessary, as was proved by the fortunate outcome

During the latter weeks of the disease, the irritability of the bladder was relieved by the use of an injection of 20 per cent argyrol after irrigation. Instillations of a small amount of 4 per cent novocaine solution also gave considerable relief. This irritability seemed dependent upon the presence of pus, which was variable in amount.

It seems clear that this case was of hæmatogenous origin and that the original focus of infection was the suppurating abdominal wound, although possibly the appendectomy may have been responsible. The condition of enteroptosis with ptosis of the kidneys would seem to have been the predisposing cause producing congestion of the organs, and imperfect drainage of urine thus preventing the safe passage of the infecting organisms through the kidneys during the process of excretion.

The following two cases were of the milder type of infection and did not require radical treatment.

Mrs. E. P., aged 25, was operated on by me for complete perineal tear and lacerated cervix, sustained in labor seven weeks previously. The uterus was punctured accidentally with the curette and was repaired through an anterior colpotomy incision. For seventeen days after her operation the patient ran a mild temperature varying from 99° to 100° F.

For the first nine days after operation it was necessary to catheterize the patient owing to her excessive nervous state. The patient's temperature had remained normal for a period of nine days and she was apparently recovered when she had a pronounced chill and her temperature suddenly rose to 103.5°. This rise of temperature lasted for six days and reached 106° F. This exacerbation occurred thirty days after the operation. Her temperature then remained normal for eight days,

after which a second exacerbation developed which was of much milder type than the preceding one, and lasted but four days, after which her temperature reached normal and remained so. There was marked irritability of the bladder prior to the onset of the first exacerbation which continued intermittently throughout the periods of temperature. The urine showed the presence of considerable pus and the colon bacillus was isolated by culture. The treatment consisted in combating symptoms and giving large amounts of water with urotropin. The patient made a good recovery and has since remained well.

It is to be remarked that the patient was catheterized for nine days following the operation and that she had a rise of temperature more than should be expected for seventeen days after operation. This, of course, indicated an infection.

Miss J. N., aged 34, was operated on by me for retroversion, endometritis, and chronic appendicitis. She gave a history of two attacks of appendicitis. She was curetted and the Gilliam operation of shortening the round ligaments and an appendectomy were done. She made an uneventful recovery apparently until the fourteenth day after operation, when she developed an irritability of her bladder, as shown by frequent and painful micturitions. On the seventeenth day after operation she developed a sudden rise of temperature which reached 104° F. This exacerbation lasted for nine days. The temperature then remained normal for a period of nine days when a second exacerbation developed which was milder in type but reached 103.5° F. This was of six days' duration, after which the temperature reached normal and remained so. There was considerable pus discovered in the urine and the colon bacillus was isolated.

The treatment in this case consisted of diluents and urotropin.

In conclusion I wish to call attention to the following points:

- 1 That post-operative renal infection is more frequent than has been formerly appreciated, owing to the fact that in many cases it is overlooked on account of the mild character of the infection; the severe types being comparatively rare.

- 2 That vesical irritability occurring after operation may be an important precursory sign of renal infection, and therefore should not necessarily be attributed to a cystitis caused by carelessness.

- 3 That a study of the urine will show the probable type of the disease present, and thus be a guide to the treatment.

4. That a careful study of the pathological condition of the kidney should be made at the operation in order that nephrectomy may be avoided if possible

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RENAL PAIN DIAGNOSTIC AND CLINICAL SIGNIFICANCE

By J. BENTLEY SQUIER, M.D., F.A.C.S., NEW YORK CITY

PAIN occurring in any part of the body is a symptom of such striking prominence that if correctly interpreted it may be considered a cardinal diagnostic sign. The researches of Sherrington, Langley, and Head have contributed greatly to the mechanism and neurophysiology of pain production. It is not our purpose, however, to consider pain mechanism or any of the phenomena of pain production but rather to confine our remarks to the clinical manifestations, topographical interpretation, and diagnostic possibilities. The variability of pain, both as to origin and radiation and its changing character render the clinical interpretation of pain for diagnostic purposes one of extreme difficulty and with many possibilities for error. However even with these limitations clearly before us pain is a most instructive diagnostic sign and one of importance in the analysis of clinical symptoms of disease.

The work of Langley on the autonomic nerves and of MacKenzie on the visceromotor and viscerosensory reflexes has contributed greatly to the interpretation of the origin of pain, the sensitiveness of tissues and the radiation of reflections of painful impulses. It has been well established that pain is due to stimulation of some portion of the cerebrospinal nervous system and is manifested by being referred to the peripheral distribution of cerebrospinal sensory nerves in the external body-wall. As a corollary of this pain is elicited only upon stimulation of structures supplied by the cerebrospinal nervous system. In addition, this hypothesis must explain pain when it results from irritation

of the viscera. Visceral pain impulses are conducted along the efferent nerves of the autonomic system, which in turn act by stimulating the cerebrospinal nerves so that the phenomena of pain, hyperalgesia, and muscular contraction in the external body-wall are indirect evidences of painful stimulation initiated by afferent autonomic nerves from the viscera. In other words when the viscera are the site of an irritative process there is conducted through the autonomic nerves or sympathetic system the impulses of visceral irritation. The stimulating effects of these on the cerebrospinal sensory nerves center in the cord, reflect the pain to the peripheral distribution of such nerves, and there is established a viscerosensory reflex. If the cord stimulation affects a contiguous motor center then contraction of the skeletal muscles occurs constituting a visceromotor reflex.

The due recognition of these factors concerned in the production of pain is of paramount importance in interpreting the diagnostic value of pain. Sherrington has demonstrated that the spinal nerves have a fairly constant and uniform distribution to the external body wall and that definite body-areas or zones may be demarked. This fact was anticipated by Head under the caption of 'Head zones' and was subsequently elaborated and confirmed by Campbell.

If one were to lay a silver dollar on the right side of the abdomen midway between the ninth costal cartilage and the umbilicus, it would cover a zone of great pain producing capabilities. A portion of the renal pelvis and kidney, the duodenum, the pancreas, the

common duct, the cystic duct, and pylorus would be subjacent to it, and a pain-provoking stimulation of one or more of these various viscera might give rise to almost any type of localized or referred pain. The fact that the renal pelvis, the ureter, and the bladder are somewhat similar anatomically to the gall-bladder, the common duct, and the duodenum, renders a certain parallelism in symptomatology at once apparent. The onset of a calculus colic, incorrectly called renal colic, is in many respects similar to the onset of a biliary colic. In both there is the sudden lightning-like onset, the same paroxysmal type of pain, the similar type but different allocation of the referred pain, and, finally, the same instantaneous relief with residual soreness. The genesis of both is similar and represents hyperactivity of a tube containing non-striped muscle-fibers.

Four main pathological conditions are apt to be confounded with renal lesions by reason of the symptom of pain. They are (1) coincident disease of the gall-bladder and ducts (Scarborough), (2) gastroduodenal ulcer syndrome, (3) appendicitis, and (4) affections of the large intestine. The anatomic relations of the descending and retroperitoneal portion of the duodenum, overlying the pedicle and the under and lower half of the right kidney, account for some atypical cases of jaundice with gastric irritability found in patients with ptotic kidneys. With these premises one will grant that the study of the diagnostic value of renal pain offers many inherent difficulties. There must be combined with the pain symptom other associated symptoms which are necessary to complete or fill out a diagnostic group. Valuable complements to pains are the presence of pathological products in the urine, nocturnal and diurnal variations in amount, frequency of micturition, with or without tenesmus, nocturia, etc.

Most of the affections of the kidney are in the beginning painless, and many of them remain so. We know that pain as a result of changes in the parenchyma of a glandular organ is extremely rare. As evidence of this we have the various nephritides of the chronic type that do not show pain unless there is a

sudden, acute congestion associated with a chronic inflammation and capsular changes. In fact, it is almost an accepted dictum that it is necessary to have stretching or tearing or pressure upon the delimiting capsule of a parenchymatous organ in order to have the production of pain. Diseases of the kidney structure *per se*, as with the affections of other glandular organs, are practically devoid of sensibility. MacKenzie states that "all the symptoms of kidney disease (apart from alteration in the size of the organ) are found in the chemical examination of the urine, in the frequent micturition, or as the result of its impaired secretion on other organs and systems (vomiting, headache, convulsions, changes in the cardiovascular system, etc.)." When a renal lesion produces pain it does so either by changing the mechanical factors of urinary secretion or by direct involvement of the capsule or pericapsular tissues. Conditions associated with rapid enlargement of the kidney almost uniformly induce pain, while lesions confined to the parenchyma without either pelvic or capsular intrusions are uniformly devoid of pain.

In interpreting renal pain three considerations present themselves:

1. Type of pain
2. Original location of pain
3. Final location of pain and its path of radiation

Kidney pain is of two general types: (a) true renal pain located in the flank and lumbar region of dull aching quality, usually of maximum intensity, of constant character, and without radiation; (b) pelvic or ureteral pain diffusely located from the lumbar region along the iliac crest of paroxysmal or colicky quality, of varying intensity, of intermittent character with radiation through the inguinal region into the scrotum or rectum or on to the thigh.

In order to establish the fact that pain is of nephrogenic origin it must be correlated with some associated finding. When this is completed the clinical picture will catalogue itself into one or another of the following groups or syndromes: thus pain with pus but without cystitis suggesting the calculus group, pain with pus, with

cystitis, suggesting the tuberculous group; pain without pus without cystitis, plus tumor, suggesting the aseptic hydronephrotic group; pain with tumor, with pus, with or without cystitis, suggesting the septic hydronephrotic group; pain with blood, without cystitis, the neoplastic or essential hemorrhagic group. It is questionable if any inflammatory disease of the renal parenchyma *per se*, without enlargement of the kidney or encroachments into the pelvis, is associated with pain. The products of any infection, however, finding an exit into the pelvis may be retained under sufficient pressure to induce ureteral occlusion with typical calculous type of pain.

A peculiarity of true renal pain is that it never becomes paroxysmal, but is always characterized by dull, constant aching. Stoop-ing is not painful, but local tenderness is found. Percussion with the whole hand so-called fist percussion (Murphy), or a blow being developed by the ulnar side of the open hand (Thompson), will cause an intense acute exacerbation of a true renal pain.

Infections of the perirenal tissues have localized pain as their most prominent symptom. It is constant, of aching character, continuous, and usually progressive. It is never paroxysmal or colicky. Although colicky pain may be manifested when blood clots, pus, or stone engage or occlude the ureter. Probably embolism or infarct of the kidney has as its most terrifying sign the development of pain, acutely, suddenly, like an apoplexy or a stroke of lightning, usually distinctly localized to the lumbar region. The pain of embolism of the renal arteries is distinguished from other true kidney pain only by the great suddenness of its onset. True kidney pain is almost always localized by the patient deeply, as away from the surface. It is away from the posterior abdominal muscle or the abdominal wall in front. This is of material aid in differentiating true renal pain from neuralgia or myalgia, which are more or less superficially located by the patient. Associated with pain are certain areas of sensitiveness of pressure. The most prominent are in the flank corresponding to the axillary line, the costovertebral angle between

the lateral border of the erector spinae muscle and the twelfth rib, and anteriorly in the region just below the gall-bladder and representing the position of the pole and pelvis of the kidney. In lesions confined to the renal parenchyma, within the capsule and without pericapsular involvement, the characteristic radiation of pain down on to the thigh is absent. It is only in rare cases that true intrinsic renal pain will be reflected on to the thigh. The kidney is not immovable, it is capable of quite a degree of mobility, and therefore, when inflammatory changes exist within the kidney or about the capsule, forcible manipulation of the organ is accompanied by more or less pain. This is also developed most acutely when the patient assumes certain positions. It is found that patients suffer most when lying upon the healthy side, and actual motion, such as coughing, vomiting, riding, and jumping causes an exaggeration of pain. The pain of infarct is so sudden as to suggest the passing of a stone down the ureter, but it is easily differentiated from the latter from the fact that the pain of infarct is after the onset, not paroxysmal or colicky, but constant, jabbing, aching, and progressive. Of additional value is the contraction of the iliopsoas muscle upon rising from bed or upon manipulation of the leg causing an acute exacerbation of the pain because of the close apposition of the kidney to the muscle. Most abdominal pains are of colicky nature and the absence of paroxysms of pain in true renal pain is of great differential importance.

The pain of lumbago is very often mistaken for renal pain. It is well to remember that the pain from lumbago is worse in the morning and improves as the day progresses. It is a pain that is considerably lessened by movement and active locomotion. Pain of inflammation of the kidney is less after a night's rest and becomes progressively worse toward evening and with active locomotion. The moment the lesion involves the renal pelvis and upper ureter we have a distinct tendency to lose the constant aching quality of true kidney pain and to have paroxysmal and colicky attacks with a marked tendency to radiation - the line of radiation being

clinically along the ureter, bladder, and scrotum, but anatomically along the distribution of the iliohypogastric, ilio inguinal, and genitofemoral nerves. The pelvis of the kidney and ureter contain non-striated muscle fibres which, upon an exaggerated stimulation, such as calculus, blood-clots, bacterial agglutinations, particles of tumor-tissue, give rise to a distinct and typical type of pain. It is colicky, intermittent, paroxysmal, begins in the lumbar region, follows the iliac crest through the inguinal region on to the thigh or into the scrotum with retraction of the testicle. It may be argued that this type of pain, if it starts in the lumbar region and remains stationary, would point to an exaggerated peristaltic activity of the renal pelvis or upper ureter and the inference that the stone, etc., is stationary. If we find a history of repeated attacks beginning in the back similar to the above we may assume that the stone is lodged in or near the pelvis of the kidney. If the stone is entirely surrounded by glandular tissue and does not project into the pelvis, it is questionable whether it can ever arouse the painful characteristics of calculus, for it seems to be conclusively proved that the excessive contraction of non striated muscle-fiber is the cause of the pain, and the calculus acts as a stimulant to such contraction. A rather common history is represented by the patient who has had a colicky calculus pain which begins in the lumbar region and gradually descends along the iliac crest and inguinal region, finally the character of the pain changes and is referred to the end of the penis or perineum, and the next day the patient passes a small calculus per urethram. The successive segmental movement of this pain is coincident and simultaneous with the passage of the calculus from the ureter to the bladder. Any lesion in or about the pelvis, ureter, calculi, particles of tissue aneurism, or carcinoma of the bladder at the ureteral orifice will occasion the pain. Pyelitis, pyelonephritis from septic occlusive changes in the ureter or pelvis, will also induce this type of pain.

It is not unusual for a pain, colicky in character, to become more constant and suggest a true renal pain. From partial or com-

plete occlusion of the ureter, distention of the renal pelvis occurs and with it damage to the kidney itself and the subsequent production of an active hyperæmia, capsular and pericapsular infiltration, etc. Thus we have the pictures of an attack of pain, colicky in nature, subsiding, and the development of a constant, localized ache of true renal pain due to changes in the renal parenchyma with stretching of the capsule and pericapsular tissues. Bevan and others have shown that the pain of acute renal colic is due more to the congestive condition and swelling of the kidney than to direct irritation of any nerve connection. The genital branch of the genitocrural nerve contains the motor nerve of the cremasteric muscle and also the sensory nerve of the tunica vaginalis, which becomes hyperæsthetic in ureteral colic, the pain shooting into the testicle. It is to be remembered that the scrotal covering of the testicle is supplied by the sacral nerves and the skin of the scrotum is never affected in true renal pain.

In pelvic and high ureteral involvement, the skin of the scrotum is not painful on pressure, but the deep tissues are. In lower ureteral and adjacent bladder regions the superficial tissues are painful, with absence of pain in the deeper tissues.

A point of extreme diagnostic value is that distention of the renal pelvis and upper third of the ureter is associated with urinary frequency, but usually without painful micturition. The development of areas of referred hyperalgesia occurs with intrarenal lesions, while extrarenal lesions as a rule give local pain and absence of referred hyperalgesia.

Backache is erroneously credited to disease of the kidney, but an extended examination of cases of nephritis, acute and chronic, gives no particular evidence of pain referable to kidney trouble. What are we to say to those dull, uncertain backaches, the relation of which to the kidney is a matter of so much controversy? Kelly stated that 60 per cent of ill-defined, right-sided pain is probably due to some disturbance in the kidney or ureter. Of all the cases of movable kidney, it is probable that a few only suffer as the direct result of the condition. Unfortunately this condition ex-

ists in many people as part of a generalized visceroptosis. It stands to reason, however, that in a not inconsiderable number of patients there is a constant drag with irritation upon the renal pelvis and indirectly upon the solar plexus. We have then a hyperæsthesia of the autonomic system with neurasthenic symptoms referable to the stomach, etc. The reasonable explanation for this is that the kidney is enclosed in two layers of fat which fuse at the superior aspects and blend with the diaphragm, which is the cause of the pain that is produced by the varying degrees of nephroptosis. Such pain is distinctly referable to the tenth, eleventh, and twelfth dorsal nerves and may be clinically reflected into the right shoulder through the phrenic part of the nerve supply of a diaphragm. A

continuous irritation of the nerve-centers of the kidney may account for the clinical observations of Prout and Morris that a one-sided lesion of the kidney may cause pain on opposite side — the so-called renorenal reflex.

We must mention also the renal hemorrhage with paroxysm of pain described by the French authors as *Nephralgie hæmaturique*. However, essential hæmaturia usually exists without pain. Pain when present is produced by the underlying factors, such as blood-clots, detached tissue, and ulceration.

It is also our opinion that pain production by renorenal reflex is not a proved entity and that a more painstaking diagnostic search will usually reveal a definite pathological condition responsible for the pain in the supposedly healthy kidney.

BLADDER FUNCTION AFTER CONFINEMENT AND AFTER GYNECOLOGICAL OPERATIONS

By FRED J. TAUSIG, M.D., F.A.C.S., SAINT LOUIS

SINCE 1902, when I published a study of urine retention based on operative records from Wertheim's clinic in Vienna, considerable literature on this subject has accumulated. It has been more concerned, however, with the therapy of post-operative urine retention and cystitis than with an examination of the factors that bring it about after confinement or operations. Particularly do we lack data concerning the time of first urination after such procedures and the amount of urine voided, in relation ship to the special conditions in each case. The present analysis of 157 puerperal and 405 post-operative cases is primarily with this object in view and is based largely on material in the service of my colleagues and myself at the City Hospital during the years 1913 and 1914.

Frequency of catheterization. It was found that out of 157 puerperal cases 6 required catheterization one or more times. This would make 3.8 per cent as compared with 5 per cent given by Meixner, 8 per cent by Waldstein, and 18 per cent by von Winckel. Among the post-operative cases the number requiring catheterization was much larger

amounting to 94 out of 405 patients, or 23.2 per cent.

Physiology. No important contribution has been made in recent years to our knowledge of the normal process of micturition. According to Mueller, Roith, and others, there are no spinal centers to regulate bladder function. The desire to urinate is primarily aroused by the filling of the bladder. At first there is merely a sensation of tenseness, and then later one of fullness and desire to void. This sensation is carried from the vesical mucosa through the sympathetic ganglia to the lower portion of the spinal cord and thence to the brain. Through spinal nerves the reflex is then voluntarily released, which causes relaxation of the external sphincter urethra, and arouses the detrusor vesicæ to empty the bladder. The emptying can be hastened by pressure of the abdominal muscles. The centers controlling this function lie in the sympathetic ganglia of the hypogastric plexus and in the ganglia lying within the bladder wall.

Normal puerperal cases. Before proceeding to a consideration of the cases requiring catheterization it is important to study the

variations in those women who voided urine spontaneously. Of the puerperal cases, 3 voided within 15 hours after the delivery of the child. The longest interval between delivery and spontaneous micturition was 22 hours. The average of all, 157 patients, was a trifle over 7 hours.

The relationship of the duration of labor to the time of spontaneous micturition was found to be as follows:

Labor short — 7 hours or less —	
Urination after 5 hours or less	24 cases
Urination after 6 to 10 hours	14 cases
Urination after more than 10 hours	12 cases
Total	50 cases
Labor average — 8 to 15 hours duration —	
Urination after 5 hours or less	18 cases
Urination after 6 to 10 hours	37 cases
Urination after more than 10 hours	6 cases
Total	61 cases
Labor prolonged over 15 hours —	
Urination after 5 hours or less	9 cases
Urination after 6 to 10 hours	15 cases
Urination after more than 10 hours	5 cases
Total	29 cases

This indicates, as we would expect, that the shorter the labor the more quickly the bladder regains its normal function.

Perineal lacerations on the other hand, did not seem to have any material influence in my series. Fifty-eight out of 151 had lacerations sufficient to require one or more sutures but they showed no delay in voiding or increased proportion of catheterizations. The 87 primiparæ showed but a fraction of a per cent difference from the 64 multiparæ in the time of first voiding urine, the figures being 7.2 hours primiparæ 7 hours multiparæ. The 18 operative deliveries in the series are hardly sufficient in number to justify any deductions as to time of spontaneous urination. They showed an average time of over 9 hours post-partum. The amount of urine voided was with few exceptions not stated in the puerperal cases.

Normal post operative cases. The 405 post operative cases covered almost every variety of gynecological operation. Leaving aside for the present the 94 cases requiring catheterization we find that the 311 women who urinated spontaneously voided on an average at the end of 12 hours. The shortest in-

terval after operation was 2.5 hours and the longest 33 hours. The following table indicates the distribution of these cases according to time.

1 to 3 hours	3 cases
4 to 6 hours	23 cases
7 to 9 hours	82 cases
10 to 12 hours	94 cases
13 to 15 hours	56 cases
16 to 20 hours	41 cases
Over 20 hours	12 cases

The amount of urine voided was not always proportionate to the time elapsing up to the first urination. Five women voided 1 ounce or less. One patient, on the other hand, voided 29.5 ounces. The average of the 311 cases was 6.9 ounces.

In my review of the literature I could find no accurate data as to the time and amount of the first spontaneous urination after operation. Holzbach states broadly that every surgeon knows he cannot expect spontaneous urination until 8 to 10 hours after the conclusion of an operation. When the patient voids, he says, usually only 50 to 60 ccm is passed, rarely as much as 200 ccm. On catheterizing such a patient we obtain 300 to 800 ccm of urine. Holzbach does not give the evidence upon which he bases this opinion. He concludes that after operation there is invariably a partial urine retention.

To test the accuracy of this statement, I made a comparison of 30 cases requiring catheterization with 30 cases of spontaneous urination after about the same time interval. The total urine obtained from the catheterized cases was 395 ounces in 463 hours, that from the uncatheterized cases was 247 ounces in 466 hours. The total period of time elapsing since operation being practically identical we can fairly compare the quantities of urine in the two groups. According to this an average of 13 ounces was obtained on catheterization while only 8 ounces was voided by the patient making approximately 5 ounces of retained urine in those women who voided late after operation. The following history will serve an illustration.

A round ligament abdominal fixation was done in a woman age 32 under ether anaesthesia. After 15 hours she voided only

3 ounces, 5 hours later, again 3 ounces, in 30 minutes, 2 ounces, in 1 hour, 5 ounces, in 3 hours, 8 ounces; in 3 hours, 8 ounces, and finally, in 2 hours, 16 ounces. Thereafter urination was normal in amount and interval of time. Summarizing, we find 6 ounces voided in the first 20 hours and 39 ounces in the following 10 hours. Only at the end of 30 hours, therefore, was the bladder function fully reestablished.

One of the interesting observations made in gathering the data for the present article was that there apparently exists normally a "small capacity" and a "large capacity" bladder. Of course gradations between these two types occur. In the 14 cases of what I term "small capacity" bladder, the average amount voided was 2 to 3 ounces, in the 17 cases of "large capacity" bladder the amount passed at a time was between 12 and 20 ounces. A typical illustration of the "small capacity" bladder occurred in a woman of 46, operated for pyosalpinx, who 5 1/2 hours after its conclusion voided 1 ounce of urine, one hour later voided 2 ounces and continued thus at regular intervals to void 2 to 3 ounces without any indication of urine retention. The patient was not nervous. Apparently in this group we have to deal with a hyper-sensitive bladder in which even a small quantity of urine produces the reflex stimulation to micturate. An illustration of the "large capacity" bladder occurred in a woman of 21, operated upon for ovarian cyst, who 21 hours later voided 12 ounces and then at long intervals passed 22 ounces, 12 ounces, 13 ounces, 14 ounces, etc. Here we have an example of lowered sensibility of the bladder mucosa. It is interesting to note that only 2 out of the 14 "small capacity" cases had to be catheterized (14 per cent as compared with 23.2 per cent of the whole series), whereas of the 17 "large capacity" cases, 9 or 52 per cent, were subjected to catheterization one or more times. Not a single one of the "large capacity" series voided for the first time in less than 10 hours. I could exclude age, anæsthetic and operation as to any degree a factor in this striking difference. We may fairly conclude, then, that the degree of bladder sensibility may be

directly responsible to some extent for the success or failure in the effort to empty the bladder.

Cases requiring catheterization post partum. Stoeckel and Ruge in their cystoscopic examination of women after delivery found almost invariably an edema surrounding the sphincter urethra. This was held responsible for the occasional cases of puerperal ischuria. Doderlein lays stress also on the increased capacity of the puerperal bladder as a factor in retention. Stricker and Engel found that while the normal bladder would hold only 450 to 550 ccs., the puerperal one could be made to contain, under pressure, as much as 1,500 to 2,500 ccs. In searching for the cause of urine retention in the six cases catheterized post partum, I found that one of them had, indeed, to a marked degree a dilatable bladder. She was a multiparous mother of 34 years, whose labor was normal and lasted but 7 hours. During pregnancy she sometimes had to strain to empty her bladder. Eight hours post partum and at intervals thereafter she voided without difficulty. After 48 hours, however, owing to a fullness of the abdomen and restlessness, she was catheterized and 72 ounces of urine obtained. Eight hours later catheterization brought 41 ounces, then she voided spontaneously again until the fourth day, when catheterization became necessary and 70 ounces were obtained. Two subsequent catheterizations brought away 32 ounces and 45 ounces, respectively. I thereupon ordered a retention catheter inserted for two days. After it was removed she was able to void normally 15 to 20 ounces at a time.

Twice the bladder atony post partum could reasonably be attributed to severe operations, once a difficult forceps for eclampsia and the other a transperitoneal cesarean section. In one patient a vaginal gauze pack could be blamed, since after its removal the next day the patient was able to void. Nervousness was probably responsible in one woman, since she had had similar difficulty in voiding urine after a simple curettement one year previously. In the remaining one of the six cases, no causes for urine retention could be found.

CASES REQUIRING POST-OPERATIVE CATHETERIZATION

	Voided	Catheterized Once	Catheterized Often	Catheterized over 3 Days
Salpingectomy for pyosalpinx	100	0	7	1
Salpingectomy for salpingitis	37	8	4	1
Salpingectomy for ectopic pregnancy	14	1	0	
Ovariectomy	0	2	0	
Laparotomy for retroverted uterus	61	12	7	2
Supravaginal hysterectomy (metritis fibroid)	27	3	2	
Abdominal hysterectomy (metritis fibroid)	70	5	3	1
Radical abdominal hysterectomy (for cancer cervix)	3	1	13	8
Eschscholization for cancer of cervix	0	0	1	
Vaginal operation for prolapse	7	7	6	3
Perineoplasty	18	5	14	6
Other external genital operations	2	2	3	1
Miscellaneous	10	0	1	

Cases requiring catheterization after operation The 94 post operative cases in whom the use of the catheter became necessary give a better opportunity for etiological study. In six for special reasons catheterization was ordered independently of the patient's ability to void, and these of course have been excluded from our consideration. An analysis as to operation and disease reveals the findings in the table above.

Where several operations were done on the same person they were tabulated under each head. In my statistics of 1902 I found that the interposition operation for prolapse and the radical abdominal operation for cancer of the cervix were particularly often followed by urine retention. Subsequent writers have confirmed these findings, and the present table is also in accord with them. Gutbrod mentioned the frequency of retention after Alexander's operation for retroversion but cited no figures. Certainly the abdominal round ligament operation for retroversion can only to a limited degree be held responsible for urine retention. Far oftener did we find it after work about the external genitals and perineum.

INFLUENCE OF ANÆSTHESIA ON MICTURITION

	Total Number	Voided	Interval to First Urination Hours	Catheterization %	Catheterization Often	Per cent Catheterized
Puerperal cases without narcotics	130	135	6.7	3	1	1.8
Operative puerperal cases (small amount of ether)	18	16	9	2	0	11.1
Spinal anæsthesia for gynecological cases	88	62	10.5	10	16	20.5
Ether anæsthesia for gynecological cases	311	245	12	11	33	21.2

Influence of anæsthesia As long as the will is excluded either by narcosis or its after-effects, the reflex process of urination cannot be established. That is why in autopsies on persons who have had a slow death, the bladder is always found filled with urine. Under spinal anæsthesia the central nervous system is not directly affected, but the chain of reflex action is broken by paralysis of the centripetal and centrifugal spinal nerves. Until this chain is reestablished, we should expect some interference with the normal mechanism of urination.

In our series the influence of anæsthesia upon the bladder function could to some degree be studied by comparing the puerperal and post-operative cases. In the puerperal group where practically no anæsthesia was required, the interval up to the first micturition was only about 7 hours, whereas in the post operative group the interval extended to 12 hours. Of special interest is the comparison of the 88 spinal anæsthesias with the 311 ether anæsthesias.

A comparison of 58 spinal cases with 58 ether cases, all of whom voided spontaneously, showed that the average time of post-operative voiding of urine in spinal cases was 10.5 hours, while in the ether cases it was 12 hours. In view of the fact that a considerable number of spinal anæsthesias were done for prolapse and cervical cancer, a comparison of the percentage of catheterization would be manifestly unjust. A fairer basis for comparison lies in the time of the first spontaneous urination as cited above, and this would indicate that, of the two, ether narcosis has a more prolonged paralyzing effect on the bladder mechanism.

Age was found to influence somewhat the

frequency of catheterization as seen in the accompanying table:

	Voided	Catheterized	Ratio
Under 20 years	47	5	9.4:1
20 to 29 years	147	3	49:1
30 to 39 years	74	10	7.4:1
40 to 49 years	74	11	6.7:1
50 to 59 years	7	11	1.5:1
More than 60 years	1	4	1:4

Apparently it can be said that the younger the individual, the better the bladder tonus and the less frequent do we find disturbance of micturition. In analyzing the various other causes that might be held responsible for urine retention I took note of such points as shock, duration of operation, extreme nervousness, vaginal or abdominal drains, unusually large amount of morphine¹ administered after operation, mental deficiency, etc. In 14 instances no cause could be found for the urine retention. In the remaining 74 I attributed it to

Bladder ptosis	1 X
Bladder pressure, retrovesical	14 X
Bladder innervation, cancer cervix	11 X
Vaginal or abdominal drains	14 X
Internal genital operations, in lab. & perineum	11 X
Nervousness	1 X
Shock or long operation	1 X
Large quantity of morphine	1 X
Mental deficiency	1 X

A number of these cases were classified under several heads. The important factors in urine retention, therefore, are interference with the blood supply of the bladder, direct or indirect pressure or irritation around the sphincter urethra, excision of the bladder nerve supply, and interference with the control of the central nervous system through anæsthetics, drugs, or mental processes.

The 21 cases of prolonged urine retention (over 3 days) occurred 8 times after the radical cancer operation, 6 times after perineal plastic, 3 times after prolapse operations, twice after excisions of vulvar carcinoma, and in the remaining instances without explainable cause.

Occasionally patients were able to void one or more times before catheterization became necessary. This occurred particularly often after the interposition operation for prolapse. Temporary incontinence of urine occurred 8

times in my series, and, since half of this number followed spinal anesthesia, the latter may to some degree have been responsible. The history of the cases gave no satisfactory explanation other than this as to the cause of the incontinence.

Retention after radical operations for cancer of the cervix. The most difficult problem in urine retention is still the paralysis following the radical cancer operation. In practically every instance catheterization is here necessary for a period of 6 days or more. The presence of large numbers of nerve ganglia in the parametrium removed at operation induced me in 1922, to explain urine retention in these cases on the basis of excision of bladder innervation. Most gynecologists have concurred with this view. Since 1923 I have done 31 such operations, and of this number only 2 were able to void spontaneously. Both were very early cases without involvement of the parametria. Of late I have adapted the use of a retention catheter in spite of the unfavorable reports of Sampson and Harnes. Franz of Berlin strongly recommends its employment. I have preferred not to use the mushroom type as Franz does, but rely upon the ordinary catheter held in place by adhesive plaster externally. Such a catheter can be readily taken out for an hour or more every day to be resterilized. We thus prevent the pressure necrosis and infection around the sphincter urethra that so often attends the prolonged use of a mushroom catheter.

Since asepsis of the urethra is impossible, we must try to combat the germs that gain entrance into the bladder through catheterization by antiseptic methods. Urotropin is given in liberal doses, 10 to 20 grains 3 to 4 times a day if tolerated, always in association with acid sodium phosphate. As a prophylactic against bladder infection we have preferred the frequent instillations of non-irritating silver solutions, such as 20 per cent argyrol, rather than irrigation with feebly antiseptic solutions like boric acid, as suggested by Hirsch. Before a cystitis is present, there is no advantage in irrigation over instillation, for there is nothing to wash away. What we want is the greatest anti-septic

¹ Morphine is mentioned by Vagel and Wassermann as occasionally responsible for pronounced urine retention.

effect accompanied with the least irritation. In spite of all these precautions, a certain number of cases will develop a cystitis, but it is usually mild and responds promptly to the customary local treatment. My recent experiences have convinced me that the danger of infection lies less in the technique or frequency of catheterization than in the presence of urine stagnation in the bladder. Albeck found that in 130 women who had a residual urine in their bladder, bacteriuria was present 52 times, whereas in 120 women without residual urine only 16 had bacteriuria; in other words we are less concerned with the comparatively few germs that gain entrance into the bladder than we are with seeing to it that they have no opportunity to multiply within that organ. Some of my most serious infections occurred in women in whom I had ceased prophylactic measure as soon as they began to void spontaneously. These women not infrequently had partial retention with stagnation of urine. Prophylactic treatment, therefore, must be continued until the bladder fully empties itself.

Prophylaxis of urine retention. The ordinary procedures need not here be considered. Werth's suggestion to fill the bladder at the conclusion of the operation is often unsuccessful and may lead to disturbance in wound approximation. Massage, as recommended by Schroeder, is only suitable for puerperal cases and is rather a rough procedure for so delicate an organ as the bladder. Ries and others claim to have had success in practically all cases by allowing patients to get out of bed to void. Leaving out of consideration the dangers accompanying such measures, when used after long confinements or serious operations we have repeatedly observed, particularly in the group of prolapse and cancer cases that while the patient was usually able to void in this position, only an ounce or two was passed at a time, so that catheterization still had to be resorted to to prevent stagnation of urine. Jansen, however, found post-operative cystitis much less frequent among patients who got up a few days after operation than among those who were confined to their bed a longer time.

In the past five years there have been many

enthusiastic reports concerning the effect of pituitrin in urine retention. Ebeler found it successful in almost all of his 45 cases, but he did not include any prolapse or cancer operations in his series. Further he insists that it is effective only in bladders that are filled to capacity. It would therefore be inexpedient to use it in any patient on whom a retroversion operation had been done. Jäschke also found it a successful means of stimulating the bladder in four-fifths of his 44 cases, but R. Franz, on the other hand, met with 9 failures out of 12 attempts. The few times I have used pituitrin, I have had only varying success. Since, however, it does away with the necessity of bladder treatment, it should be given a trial in the lighter grades of urine retention. I would suggest in suitable cases using it in combination with getting the patient out of bed.

Ever since Baisch, in 1903, advised the injection of 20 ccm. of a 2 per cent boroglycerine solution into the full bladder, it has been generally adopted in the treatment of urine retention. In the more prolonged retention cases it fails to give results. I object to this method of treatment partly on this account and partly because in a number of cases I got the impression that the irritation of the glycerine was responsible for the severity of the attendant bladder infection.

While I have not had occasion to try the soap glycerine bougies of Waldstein, I should think the same objections would hold true of them, beside which the application and keeping of such bougies seem unnecessarily complicated.

In searching for some mild intravesical irritant that would be easy of application and would not predispose to severer infections of the bladder, I decided to try the effect of simply injecting several ounces of air into the full bladder. The many occasions on which, in using air dilatation with a Kelly cystoscope I had occasion to observe pronounced bladder contractions as a result made me feel that the mildly irritant effect of air might relieve the urine retention. Thus far I have used it eleven times, with success in all but one case. The technique is simplicity itself. If urine has not been voided for 12 hours

LABORATORY DIAGNOSIS OF CHRONIC INFECTIONS OF THE URINARY TRACT IN WOMEN

By ARTHUR H. CURTIS, M.D., F.A.C.S., CHICAGO

IN the study of chronic infections of the urinary tract distinct advantages are possessed by one who adds clinical experience and a knowledge of cystoscopy to active participation in laboratory work.

Division of labor in this field tends to introduce many errors. The laboratory worker knows little concerning which procedures are best adapted to the establishment of a diagnosis unless he is conversant with the clinical findings and special features of importance as revealed by cystoscopic examination. On the other hand, the clinician who depends upon laboratory reports is also handicapped, for he seldom knows whether specimens arrive at the laboratory in proper condition, or whether they have been satisfactorily examined without delay. A routine report is at best but a poor substitute for personal study of the material.

SPECIAL FACTORS OF IMPORTANCE IN ROUTINE EXAMINATION

Pus There is a tendency to disregard a moderate amount of pus in the urine on the assumption that it is ascribable to contamination from a vaginal discharge. The discovery of its presence should be followed by examination of another specimen secured after a preliminary douche and tamponade of the vagina, or, better, after withdrawal by catheter.

Likewise too little emphasis is laid on the fact that *persistent pyuria*, in the absence of a gross bladder lesion, such as stone or retention of urine, is almost invariably due to kidney disease. It is to be regretted that the profession is not more impressed with this fact and not more awake to a realization that the place of formation of urinary pus can be definitely localized through the assistance of ureteral catheterization.

In the examination of ureteral specimens little significance attaches to excessive flow of urine from one kidney. Nor should we forget, in event of catheterization polyuria,

that but few pus-cells may be evident in a kidney specimen which under usual conditions contains pus in abundance.

Idiopathic hæmaturia Among the causes of hæmorrhage in cases formerly classified as idiopathic hæmaturia, not only is there the possibility of a hidden tuberculous focus, but increasing experience with cultures forcibly impresses me with the frequency of other infections. No case can rightfully be relegated to the idiopathic class until modern cultural methods, especially anaerobic cultures, have failed to show infection.

Bacteria When there is urinary retention, or if treatment has included bladder irrigation, bacilluria is naturally of frequent occurrence. It is worthy of note, however, that urine from normal individuals tends to be bacteria-free. This lends added interest to the work of G. F. and G. R. Dick, who regularly secure positive cultures in cases of nephritis and are able to produce experimental nephritis through injection of specific nephritis producing organisms.

Without entering into a discussion of vaccines, I wish to emphasize a belief which is becoming more firmly rooted as my experience increases: autogenous vaccines, in infections other than those with bacilli of the colon group, are sometimes beneficial, but do not commonly cure the patient; colon bacillus vaccines, on the other hand, yield a surprisingly high percentage of cures. Failure to obtain results with carefully prepared and administered autogenous colon bacillus vaccines is indicative of trouble greater than a simple infection, such as kidney abscess, stone, retention of urine, or complicating tuberculosis.

THE MAKING OF CULTURES

Media One per cent dextrose ascites agar shake cultures give more uniformly satisfactory results than any other media I have used. Growth often occurs in this when blood agar slants and plates remain sterile.

Failure to obtain growth on plates is more usual than is generally recognized, although employment of a moist chamber materially adds to the percentage of positive results.

A technique which may be employed in special cases when bacteria are widely scattered and grow with difficulty is the following: Centrifuge the catheterized specimen as usual. Mix the sediment with a few cubic centimeters of blood and make a large number of ascites blood agar tubes containing less than the usual percentage of blood. If bacteria are present they encounter ideal conditions for growth and colonies which develop in the slightly blood tinged culture media are readily seen and isolated. Imbedded colonies are exposed by breaking the tube at any desired level, this is accomplished through stroking with a file, followed by application of a red hot glass point.

Repetition of cultures. The presence of very few colonies, especially if these show organisms of more than one kind, gives rise to uncertainty best relieved by making a fresh set of cultures. Likewise, the finding of certain bacteria which are common sources of contamination suggests a slip in technique. Before deciding that these play a rôle in the production of disease, it is well to repeat the work with careful scrutiny of all details.

Anaerobic cultures. The French have shown that anaerobes play an important part in infections of the urinary tract. Anaerobic cultures should be made in the majority of cases, the dextrose agar shake technique and the pyrogallie acid method of Wright have a simplicity that commends them.

Ureteral cultures. With all care in preparing cystoscopes and catheterizing ureters even moderate surgical cleanliness is difficult, satisfactory technique for bacteriological cultures is still less easy to attain. On this account cultures of ureteral specimens should be controlled by simultaneous study of the bacteriology of the bladder urine.

Cultures when urine proves sterile. In those patients who suffer with irritability of the trigone and urethra, and who void urine which is persistently clear, cultures often show no growth. At such times cultures from a probe passed into Skene's ducts with delib-

erate traumatism of the lining membrane may yield colonies of the gonococcus. Less often, growth results from cultivation of material obtained after massage followed by introduction of an applicator into the urethral canal.

LABORATORY DIAGNOSIS OF TUBERCULOSIS

It is common knowledge that idiopathic hematuria or pyuria makes advisable a search for evidences of tuberculosis, and that colon bacillus infection of the urinary tract, without a history which accounts for its presence may conceal an underlying tuberculous infection. Also when locating the focus of infection, it cannot be too often emphasized that the presence of tubercle bacilli in the urine commonly signifies a renal tuberculosis and not an infection confined to the bladder. It is true that bacilli may filter through the urinary tract without producing a lesion but such occurrences, with tubercle bacilli numerous enough to be found in the urine, must be uncommon indeed.

The ease with which advanced tuberculosis is recognized permits us to especially consider those cases with less evidence of the disease. In the examination of patients in whom definite findings are difficult to obtain, certain details in technique may be advantageously employed. Provided the lungs are normal potassium iodide may be given for a period of several days, this is followed by the administration of one tenth milligram old tuberculin twenty four to forty eight hours before examination. Massage of the kidneys several times daily in conjunction with the iodide and tuberculin tests aids in the production of a focal reaction. Finally, liquids are limited to a minimum before collection of specimens with the twofold object of irritating the kidney through concentration of solids and increasing the number of bacteria in a given quantity of urine.

As a routine procedure, medium-sized guinea pigs are injected intraperitoneally with the sediment from several tubes of centrifuged urine previously washed with normal salt solution to decrease its toxic action. Injection into the liver or traumatized inguinal glands is probably best reserved

for urgent cases, and should be controlled by intraperitoneal injection of other pigs

A high power centrifuge is essential in the search for bacilli in fresh specimens. These machines are vastly superior to the ones in ordinary use and make immediate examination of the urine a procedure of much diagnostic value. It would seem scarcely necessary to mention that numerous specimens should be examined in all doubtful cases.

The organisms with which tubercle bacilli are likely to be confused are chiefly smegma bacilli and water contaminations. Consideration of the clinical history, care in collection of specimens and in differential staining, animal inoculation and cultivation by Petroff's method⁴ are useful at such times. Petroff's technique promises to be of much aid, and gives more prompt results than animal inoculation.

FUNCTIONAL TESTS AND NEPHRECTOMY

Consideration of functional kidney tests would too greatly extend the confines of this paper. Therefore only one phase of the subject will be mentioned in closing.

Phenolsulphonephthalein and other functional tests are unquestionably of value when nephrectomy is under advisement. I wonder only whether we do not lay too much stress upon their importance. The characteristics of the urine from the opposite kidney — its amount and specific gravity, the quantity of albumin, pus, bacteria, and casts contained, always with consideration of just how much disease and how much secretory power the questionable kidney reveals — still remain, to my mind, the most reliable guides.

⁴Petroff *J. Exp. Med.* 1915 xvi Jan.

CONCLUSIONS

1 Chronic infections of the urinary tract can be best diagnosed by one who is actively engaged both in clinical work, including cystoscopy, and in laboratory study. Careful correlation of clinical findings and laboratory methods, with extensive modifications in cultural technique to meet individual cases, is essential.

2 The source of even small amounts of pus in the urine should be investigated, the place of its formation can be definitely localized through ureteral catheterization.

3 Persistent pyuria in the absence of a gross bladder lesion is almost invariably due to kidney disease.

4 In those frequent cases with bladder irritability which yield clear, bacteria free urine, cultures from the traumatized urethral canal, or from introduction of a probe into Skene's ducts, may demonstrate the cause of infection. When bacteria are widely scattered or grow with difficulty, a mixture of the urinary sediment with blood, followed by the making of a large number of ascites-blood-agar tubes of high dilution, results in conditions favorable for the development and isolation of the bacteria present.

5 Experience teaches that the chief lesions in urinary tuberculosis are usually renal. In obscure cases, laboratory diagnosis is facilitated by potassium iodide, tuberculin kidney massage, limitation of liquids, repeated examinations of fresh specimens after high-power centrifugation. Petroff's cultures, and injection of series of medium-sized guinea pigs.

6 There is seemingly a tendency to lay undue stress on functional urinary tests at the expense of careful routine examination.

SOME ERRORS IN THE DIAGNOSIS OF RENAL INFECTIONS

By ARTHUR L. CHUTE, M.D., I.A.C.S., Boston

THE objective signs of renal infection, as shown by the urine, are so definite that the application of exact diagnostic measures, namely, the use of the catheterizing cystoscope and the microscope, should, in practice as well as in theory, lead to the correct recognition of these cases in all but rare instances. That this is not the case I think any one with any considerable surgical experience will attest. In this paper I shall give what I have found to be some of the common errors in the diagnosis of renal infections and the reasons for these errors. First, I will take up some of the reasons for these errors.

In my opinion the greatest cause for errors in the diagnosis of renal infections is a lack of appreciation on the part of the general practitioner, under whose care these cases come first, of the conditions under which renal infection gives pain, and the sort of pain that such an infection usually gives.

In the first place I believe that due to the nerve supply of the kidney, only a condition that suddenly puts tension on the kidney capsule causes renal pain. This limits the appearance of pain to acute infections that are attended with so much swelling or congestion as to sharply overdistend the renal capsule. That every acute infection of the kidney does not do this is proved by the great number of cases of acute pyelonephritis that one sees where there is relatively little pain, due to the fact that the swelling is not sufficient to distend the capsule to the painful point.

In the chronic renal infections pain is not a prominent symptom, unless there are combined with the infection attacks of intermittent obstruction that suddenly distend that part of the capsule covering the pelvis of the kidney. Slow distention of the kidney even if it is quite marked — like that of a renal tumor, for instance — is rarely attended with acute pain. Apparently in such conditions the capsule has time to adjust itself to the changed relations

In these cases where there is pain due to an infection of the kidney, it will be found that the pain is rarely backache, which is the only type of pain that many are willing to believe an infection of the kidney produces. The pain, it is true, may have its origin in the loin and under certain conditions remain there, but there is a great tendency for it to become generalized abdominal pain, and it may be abdominal from its very start. This, I think, is especially likely to occur in cases where the pain is very severe; as, for instance, in the distention of the kidney capsule that occurs during the passage of a ureteral stone along the ureter.

Not only is the pain abdominal in type, but frequently, especially when acute, it is accompanied with vomiting which further tends to center the attention upon the abdomen rather than the kidneys. In these cases of renal infection, the tenderness, of course, is largely limited to the loin, regardless of the position to which the pain is referred. To have a typical pain across the small of the back of the type that so many people demand before suspecting an acutely infected kidney, it would be necessary to have a double renal infection — a relatively rare condition. The lack, then, of pain which in the eyes of the general practitioner suggests pain of renal origin is one reason why many patients suffering from kidney infections are not sent to the men who have the means and the skill by which alone accurate diagnosis of renal infection can be made. In passing I may say that I feel it is as much out of the question to expect the general practitioner or the general surgeon to be able to do this work accurately, as it is to expect either of them to make, for instance, a complicated examination of the eye. Nor do I believe that this work is ever going to be done accurately except by those men who devote a great deal of their attention to it.

There is yet another point that throws the general practitioner off his guard in dealing with these cases of renal infection. This is

the lack of renal tube casts that the urine from an infected kidney ordinarily shows. Casts are so intimately connected with the medical diseases of the kidney that many men feel that their absence indicates freedom from any form of renal disease. Casts, it is true, are not necessarily absent in infections of the kidney, but on account of the large amount of pus often present, they are relatively infrequently recognized.

This lack of the sort of pain that is supposed to indicate kidney disturbance, and this lack of renal casts, are often associated with a frequency and urgency of urination that point to an acute infection of the bladder, and acute cystitis is considered sufficient in the opinion of many men to account for the pyuria and the possible elevation of temperature that the case shows. The accounting for an elevation of temperature by a cystitis is, I believe, a very common error, it has been my experience that one rarely sees any appreciable elevation of temperature with a cystitis, and that urinary suppuration which is attended with any real elevation of temperature is almost invariably renal in origin, though elevation of temperature may be seen in those instances where a cystitis is accompanied by a prostatitis or vesiculitis. In women, I believe any urinary infection accompanied with temperature can be referred to the kidneys.

Errors in the diagnosis of renal infection are due almost entirely to the fact that the possibility is not brought to the mind of the man who sees the patient originally, and therefore accurate measures for diagnosis are not applied.

There is another and smaller class of cases however in which the error arises from the fact that though the chance is afforded, we are unable for one reason or another to apply our accurate diagnostic means. Sometimes this is due to the fact that the patient is seen under circumstances that make this impossible, then again, it may be due to the fact that we are unable to catheterize the patient's ureters, because of some physical impediment, such for instance, as a flexed and adducted thigh, due to old hip disease, or an extrasensitive bladder or one that bleeds

especially easily. The classical requirements for successful catheterization of the ureters are: a urethra that will allow the passage of a cystoscope, a bladder that will hold a moderate amount of fluid, a bladder in which the fluid can be kept sufficiently transparent so that one can see. These are necessary for the accurate diagnosis of most renal infections.

There are other cases where error in the diagnosis of a renal infection is due to the fact that the conditions seem so evident that the application of the exact means does not seem necessary or worth while. This condition perhaps is most strikingly exemplified in cases where the compensatorily hypertrophied kidney is taken out, in cases of one-sided renal tuberculosis. No matter what the immediate reason, the underlying cause for errors in diagnosis of renal infection is the fact that for some reason, avoidable or unavoidable, the methods of exact diagnosis have not been applied.

It is easiest to illustrate my points by citing briefly cases that have led to mistaken diagnosis. Naturally these cases for the most part have been those in which the error has been on the part of some one else. My own errors, though probably equally good for purposes of illustration, have remained for the most part for some one else to discover and are not available for my own use.

The commonest errors occur in the cases that are either unattended with pain or in which, if they present pain, it is referred to the bladder. The importance of these errors depends on the type of infection in the first instance and also upon its intensity. Thus the ordinary pyelitis, due to the common pyogenic organisms, is usually considered a cystitis, and during the acute stage I am inclined to think that perhaps it is just as well it is not recognized, lest there might be an unfortunate attempt to treat it surgically. Ordinarily it is only in the cases where the process becomes chronic and a careful examination is made that the condition is recognized.

These cases are so commonly seen as to make it hardly worth while to give an example. A typical instance was the following

A young woman in the early twenties, who, following the birth of her first child, had repeated attacks of frequent and more or less painful urination. This had persisted over a year or more and treatment had failed to give her relief. Her urine showed pus in rather small amounts with a moderate number of organisms, supposed to be colon bacilli. Her bladder was fairly tolerant and showed a little congestion at the base. The urine from her right ureter showed a little pus and some organisms. The pelvis would hold only about 7 ccm. A ureter catheter showed normal urine from the left kidney. Washing out the right renal pelvis a few times with a weak solution of nitrate of silver was followed by freedom from symptoms and by a transparent urine. I was unable to palpate her right kidney or to get any tenderness. The bladder symptoms in this patient were considered due to some pelvic condition following her confinement.

Had a catheter specimen of her urine been examined — a thing which should always be done in women who complain of bladder symptoms — evidence of urinary infection would have been unmistakable. In women it is very unsafe to draw any negative conclusion from a voided specimen of urine. There is a great tendency in drawing conclusions based on such specimens to assume that the little pus and few organisms that the urine may show in a mild pyelitis are of vaginal origin.

A pyelitis is ordinarily to be suspected when, with the signs of a urinary infection, there is associated a moderate temperature or when the urine shows rather more albumin than the quantity of pus would account for. The finding of tenderness in one loin heightens the probability of pyelitis. The finding of the products of infection coming from a kidney on catheterization of its ureter clinches the diagnosis.

Errors in the minor infections of the kidney are usually not very important. With the more intense grades of infection an error in diagnosis is more important. I will cite a case of this sort that recently came under my observation.

A woman of 61 was seen late in February for a little more than a week she had been having frequent and painful urination. Her bladder had been treated locally without relief, and for a day or two before she was seen her urine had been bloody. She had a temperature of 99.2°, she was voiding urine every ten or fifteen minutes, her urine showed considerable pus. Cystoscopic examination was very

unsatisfactory as her bladder would hold only a little over an ounce. There was a question of dilatation of the mouth of the right ureter. Catheterization of the ureters was, however, out of the question, because of the sensitiveness of the bladder. There was a slight tenderness in her right renal region. Symptomatic treatment was advised. She improved for a time, then her temperature went up, she had chills and her right kidney became plainly palpable. Her bladder was so hypersensitive that there was practical incontinence. Cystoscopic examination, even under ether, was without result. The right kidney was exposed, a pus-containing kidney found and incised and a large tube put down into its pelvis. Later the dressing showed the characteristic color of the pyocyanus infection. Ten days after operation I was able to catheterize both ureters with ease. The left ureter showed a normal urine as might be inferred from the drop of temperature to normal and the greatly increased bladder tolerance following drainage.

In this case an error was made in assuming that an infection that proved to be renal was confined to the bladder. At the time of operation I was unable to remove the diseased kidney, because I was unable to apply our exact methods of diagnosis, due to a hypersensitive bladder.

Since in tuberculous infections of the kidney one rarely has a sufficiently acute swelling to overdilate the renal capsule and therefore to cause pain, the subjective symptoms are usually referred to the bladder. If a renal infection is tuberculous delay in its recognition is important since it may lead to a deeper involvement of the bladder and consequently, to a longer period of recovery following the removal of the kidney, if, indeed it does not bring about changes in the deeper layer of the bladder which will lead to permanent interference with its function. Then too there is the small danger of an ascending infection on the other side.

A woman age 32 single seen some months ago illustrates well the bladder symptoms of renal tuberculosis. This patient fell some four or five months before I saw her striking the abdomen over the general region of the bladder. She began shortly afterward to have frequent and painful urination at times passing a bloody urine. She had a good deal of treatment for her bladder including a month's stay in a hospital with daily bladder irrigations but had no relief. When seen by me her bladder was decidedly intolerant. Her urine showed pus and tubercle bacilli. There was redness about her right ureter, her left ureter was catheterized

and gave a normal urine. There was difficulty in catheterizing her right ureter, and so the attempt was not persisted in as it was evident, even without the slightly enlarged, slightly tender right kidney, which could be felt on palpation, that the signs of infection came from her right side. A typical tuberculous kidney was removed through a lumbar incision and four months later the patient had gained thirty pounds in weight and was free from her frequency except when she was very tired. Her bladder still showed a somewhat abnormal condition which was steadily improving.

The renal infections that are attended with pain, especially when this pain is referred to the abdomen, are quite naturally the ones that are mistaken for the commoner acute abdominal conditions. An acute appendicitis is the most common acute abdominal lesion, as well as the one that often presents very atypical symptoms. It is this condition with which a right renal infection, giving abdominal pain is most often confused. There is a condition that simulates appendicitis especially well, and of which I remember having seen two examples. This is where there was a renal infection due to a stone blocking, in one instance the kidney pelvis, in another, the ureter in the general region of the third or fourth lumbar vertebra. The acute general abdominal pain due to the renal distention and infection, combined with a tenderness due to the presence of the stone in the ureter, gives a picture that I believe is almost sure to mislead. It is only when the appendix is found to be normal or the attacks persist after it has been removed that a more careful search is made and the condition is recognized. The following is one of the cases I have just referred to.

Some time ago I saw a young woman of 23 who had been operated upon for appendicitis about three years before. Following her operation for appendicitis she had two operations at intervals of some years to separate adhesions that it was believed followed the operation for appendicitis and which it was supposed produced the frequent attacks of abdominal pain which she suffered. When I saw this patient she had just recovered from one of these attacks of acute pain attended with vomiting. Her urine was turbid and had been for several years according to her history. She had found it necessary for a long time to get up at least twice at night. A slightly enlarged right kidney was made out. Radiography showed a stone in her right kidney pelvis. This was removed, and when the

patient was last seen, a year after her operation, she had had no recurrence of her acute pain.

In this patient the history of urinary symptoms, frequent urination, and a long-standing turbid urine should have led to a more careful examination, especially of the urine. The microscopic examination of this alone should have raised the question of her trouble being of urinary origin.

While it is undesirable to remove a normal appendix because of the abdominal pain due to an infected kidney, this is a slight misfortune compared to overlooking an acute appendix and allowing it to go on to rupture and possibly a fatal outcome, because there is a chance that the pain may be due to an acute infection of a kidney. I therefore think one cannot advise being too fearful of making a mistake of this sort, as the other alternative is more disastrous. I believe, however, that there is a golden mean that will diminish the unnecessary operations and not jeopardize the patient's safety.

Other renal infections may be confused with certain painful non-surgical conditions of the intestinal tract, as was a case of slightly infected hydronephrosis that I saw in a woman of 60 some two or three years ago. She had had attacks of acute abdominal pain since she was a little girl. These had been considered various things, and she had been given all sorts of treatment, often with temporary benefit, but with no lasting relief. A little while before I saw her she had passed bloody urine on one or two occasions. I found an intermittent hydronephrosis on her right, mildly infected. The removal of her right kidney, which was little more than a shell, did away at once with her pain, and more than two years after operation she had had no recurrence of her symptoms.

An infected right kidney may give symptoms that may be mistaken for those of cholecystitis, as exemplified by a man of about 30 whom I saw some two years ago. This man had attacks of acute pain in his right loin that later became general abdominal pain. His appendix had been removed and at a later time his gall-bladder was opened, but no stones were found. His attacks persisted. He was radiographed and found to

show a stone low in his right ureter as well as one in his left kidney pelvis. Both were removed and the man was perfectly well for a considerable time afterward, though I am told that during the past winter he had an attack of pain followed by the passage of a small renal stone.

A patient of 30 whose second child had been born a year or two previously came under my care some five years ago. She had had several operations mostly for pelvic conditions. The year before her left ovary had been removed for pain which had persisted until the time that I saw her. It had been unchanged in character and it seemed fair to believe was due to a kidney. She had had urinary symptoms for some time, not only a very turbid urine, but likewise a leakage of urine. Bladder examination showed a much dilated left ureter from which were pushed out at times solid molds of pus.

Palpation of her left loin showed a mass that was tender and the size of a large orange. Examination of the bladder likewise showed an abnormal opening to the inside of the left ureter. This proved to be a vesicovaginal fistula. The left kidney was cut down upon and removed. It was simply a pocket of pus, the walls of which were very much thickened, showing, in my opinion, that it was of long standing. The vesicovaginal fistula was likewise closed and when last heard from the patient had been free from her former attacks of pain and temperature.

The above illustrate the commoner types of error in the diagnosis of infections of the kidney as I have seen them. The list of individual errors, however, might be very considerably increased. For the most part these errors are avoidable when we have the opportunity to study the patient carefully.

SHOCK AND HEMORRHAGE AN EXPERIMENTAL STUDY

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THE experimental study of the phenomena termed "surgical shock" is difficult because what constitutes shock has never been very clearly defined. This has led to many conflicting data and diverse theories. It is necessary, therefore, to define carefully what is meant by "surgical shock" and to prescribe the limits of its clinical application.

In a previous article (1) I have outlined the experimental conditions under which could be made a study of the symptom complex of post-operative shock. In order to give definite value to the work, two factors have been closely observed: (1) a uniform method of producing shock, and (2) the reduction of the animal to the condition of shock as defined in my previous study of the subject, i.e., (a) great loss of sensibility, (b) pallor of mucous membranes, (c) small, weak pulse, (d) irregular, rapid, shallow, or gasping respiration, and (e) materially lowered blood pressure.

In regard to the first factor, I have pointed out the impracticability of attempting to produce by traumatizing nerve-trunks, joints,

etc., the condition in which the clinical signs of shock are present. The only uniform method of producing shock experimentally is to open the abdomen and expose the viscera. It is obvious that only the condition known as post-operative shock can be the subject of experimental investigation. Psychic shock and the use of the term as applied to railway accidents are not subjects for experimental observation, and it is futile to seek a common cause for all these varied manifestations.

All my data on shock have been secured from experiments on animals in which the clinical signs as enumerated, appeared when the viscera were exposed. These results are comparable with those obtained by other experimental observers inasmuch as most observers have produced shock by visceral traumatization. Clinically my results may be applied to the shock produced during operation.

It is generally conceded by clinical and experimental investigators that shock is in some manner associated with circulatory failure, due either to a cardiac or vasomotor

impairment. In either case overstimulation of the nervous system has been considered the cause of this profound depression of the circulation. Numerous experiments have established the fact that the heart is not primarily impaired in shock but is able to do its work efficiently if enough blood is returned to it. It has been almost as conclusively proved that the vasomotor center is not fatigued or exhausted. On the contrary, this center is probably in a state of hyperirritability until the condition is moribund and is vainly striving to maintain blood pressure at its normal level.

Henderson (2) has pointed out that stagnation of the circulation does not necessarily mean cardiac or vasomotor failure. He emphasizes the fact that it is the function of the heart to pump and the function of the vasomotor system to regulate peripheral resistance. Given a sufficient amount of blood, equilibrium is preserved, and these two factors are able to maintain a normal blood pressure. However at a point of its cycle distal to the arterioles in the capillaries and venous reservoirs the blood encounters a place where it is more or less beyond the control of the heart and vasomotor system and another factor becomes essential to the maintenance of effective circulation—a mechanism which will return the blood from the capillaries to the heart. An impairment of some part of this mechanism can produce a failure of circulation despite an effective pump and vasomotor system. Henderson believes this mechanism to be injured in shock by loss of carbon dioxide. This causes the walls of the veins to lose tone and the tissues to undergo changes whereby they imbibe more water from the blood and thus diminish the amount of circulating fluid.

As the result of a previous investigation I concluded that shock produced by the exposure of the abdominal viscera was due to a loss of circulatory fluid the causes for this loss probably being the same as those producing the stasis which pathologists consider as part of the process of inflammation.

The problem at hand was to determine whether there is in shock an actual loss of circulating fluid and, if so, whether the loss can

be accounted for simply by vasomotor failure. In a measure the problem has been solved by Lyon and Swarts (3), who found that the percentage of blood was decreased in all organs after shock.

The amount of blood that can be obtained from a large arterial trunk—as the femoral—is the measure of efficient blood, it is the amount which can be returned to the heart and lungs and, after aeration, be pumped out to feed the tissues. The blood which can be secured from the venous side of the circulatory system—as from the right auricle—is the amount that is freely movable but was not returned to the arterial system. Their sum is the amount of mobile blood in the body. This sum subtracted from the total amount of blood gives the quantity of immobilized blood, the fixed quantity in the tissues. So far as the immediate circulatory needs of the organism are concerned, this latter amount of blood is useless.

In my experiments the total amount of blood was estimated in its relation to the body weight. The percentage used was 7.7 per cent, or one-thirteenth of the total weight of the animal. This standard is open to a certain degree of error, particularly since it was impossible to obtain enough dogs of approximately the same size and breed. However, this source of error was reduced to a minimum by using in each series the same type of animals in the same physical condition and, as the study is of comparative conditions, the variation does not materially affect averages.

The general technique was uniform in all the experiments. The animal, which had been fasted for eighteen hours, was etherized and carefully weighed. The anesthesia was maintained by the auto-intratracheal inhalation method (4). Blood pressure was taken from the right carotid artery. A cannula was placed in the right femoral artery. After performing the experimental procedure, such as producing shock, sectioning the spinal cord, etc., the femoral artery was opened and all the blood that could be secured was obtained. The thorax was then opened, the pericardium stripped over the heart, and turning the animal on its side in a slight

TABL. II

Experiments	Percentage Obtained from Femoral Artery	Percentage Obtained from Right Auricle and Cava	Total Percentage Obtained	Percentage Left in the Tissue
Series of normal animals	66	10	76	24
Series in which the cervical cord was sectioned	54	11	65	34
Series in which ether was pushed until respiratory failure	45	13	58	41
Series in which shock was produced by exposure of abdominal viscera	28	11	39	61
Experiment in which the spinal cord from sixth cervical segment peripherally was destroyed	42	13	55	45
Experiment in which after the production of shock, adrenalin was given and the animal bled when blood pressure had reached its highest point	38	8	46	54

Trendelenburg position the right auricle and, later the cava were opened, allowing the blood to flow into a wide-mouthed receiver. The exact weight of the separate specimens was recorded.

The observations fall into four different groups: (1) In the first series normal dogs were used as controls to determine how much blood can be obtained by the method described, (2) in the second series the cervical cord was cut before bleeding, (3) in the third series the animals were practically killed with ether and the bleeding was done after the institution of artificial respiration, (4) in the fourth series the animals were shocked by exposure of the abdominal viscera. Several special experiments devised to emphasize certain points are also reported (Table I, Detailed observations, Table II, Condensed data).

In the first series the blood pressure was taken with the normal animal in a moderate depth of etherization and then the bleeding from the femoral artery was started. From these animals we obtained an average of 66 per cent of the blood from the femoral artery, 10 per cent from the heart, making a total of 76 per cent obtained and leaving 24 per cent in the tissues. These results are a fair average for the experimental conditions under which they were secured and form the standard of comparison for the results of all the other experiments. The following is a representative protocol.

Experiment 13 March 6, 1915 Dog, rather poor brindle bull weight 930 gms. The animal was etherized carotid blood pressure taken and a cannula placed in the right femoral artery. Normal

blood pressure 145. From the femoral artery 476 gms of blood were obtained and 60 gms from the right auricle. The estimated total amount of blood was 717 gms. From the femoral artery 66.3 per cent was recovered and 8.3 per cent from the heart, making a total of 75 per cent obtained and leaving 25 per cent of the blood in the tissues (Fig 1).

In the second series the cervical cord, usually the sixth or seventh segment, was sectioned before the bleeding. As this severs practically all the vasoconstrictor fibers from their connection with the medullary center, the procedure simulates as nearly as possible a total paralysis of the medullary vasomotor center. The fall in blood pressure induced by this operation approached that observed in shock in but a minority of cases. It should be borne in mind that even with the most careful hæmostasis some blood was lost during the operation. The blood pressure was allowed to reach a constant level before the bleeding was started. From these animals an average of 55 per cent of blood was obtained from the femoral artery and 11 per cent from the heart, making a total of 66 per cent recovered and leaving 34 per cent in the tissues. It is thus seen that after removal of the influence of the medullary vasomotor center an increase of 10 per cent of blood remained in the tissues. The following protocol is a good example of this series.

Experiment 9 March 5, 1915 Dog, brown and white male mongrel, weight 24,383 gms. 9:45 a.m. Etherized carotid blood pressure taken, cannula placed in femoral artery. 9:55 a.m. Pulse 158, respiration 36, blood pressure 150. 10:07 a.m. Incision made for exposing spinal cord. 10:27 a.m. Cord sectioned (seventh cervical segment), blood pressure fell to 100. 10:40 a.m.

Bled from the femoral, obtaining 900 gms. of blood, 105 gms. obtained from the heart. The estimated amount of blood was 1,875 gms.; 54 per cent was obtained from the artery and 46 per cent from the heart, making a total of 64 and leaving 36 per cent in the tissues.

In order to test the effect that blood pressure might have upon the quantity of blood obtained, a complete failure of respiration and a more or less complete vasomotor paralysis by overetherization were produced in a third series of experiments. After taking the normal blood pressure in these animals ether was pushed to the point of respiratory failure. When the blood pressure had practically reached zero and no pulsation could be felt in the femoral artery, artificial respiration was instituted by means of alternate thoracic and abdominal compression and the bleeding was started. Spontaneous respiratory movements returned in but one experiment, and in this case they were of the convulsive type. It usually required about twice as long to obtain all the blood in animals of this series as in the controls. I was very much surprised to find that under such conditions an average of 46 per cent of blood could be obtained from the femoral artery, 13 per cent from the heart leaving 41 per cent in the tissues. In these animals there was an average increase of 17 per cent of blood left in the tissues as compared with the amount in normal animals. Experiment 26 is a typical experiment.

Experiment 26 March 11 1915. Dog male shepherd, weight 16,018 gms.

3:40 p.m. Etherized. Apparatus arranged to record carotid blood pressure. Cannula placed in right femoral artery 3:50 p.m. Pulse 140, respiration 22, blood pressure 128. 3:52 p.m. Began to push ether. 3:56 p.m. Respiration failed. 3:59 p.m. Blood pressure reached zero, no pulsation in femoral artery. Femoral artery opened, thoracic and abdominal compression started. From the right femoral artery 625 gms. of blood were secured, 200 gms. from the heart. The estimated amount of blood was 1,301 gms. This makes 49 per cent from the artery, 15 per cent from the heart, a total of 64 per cent, leaving 36 per cent in the tissues (Fig. 4).

In the fourth series of experiments after obtaining the normal blood pressure the right vagus was sectioned and the central end

stimulated for the purpose of testing the response of the vasomotor center to reflex stimulation. Two such tests of the vasomotor center were made before the abdomen was widely opened and the viscera exposed. When the resulting condition fulfilled all the clinical requirements for shock, the response of the vasomotor center was tested a third time. In every case the response was practically the same in the shocked condition as in the control. After this procedure the animal was bled. None of these experiments produced a very low blood pressure and the reaction of the vasomotor center was normal. An average of only 28 per cent of blood was obtained from the femoral artery, 11 per cent from the heart, making a total of 39 per cent obtained, leaving 61 per cent in the tissues. This means that in these animals less than 40 per cent of the blood was available and that almost 37 per cent more than the normal amount was stagnated in the tissues. Such a loss of circulating fluid is sufficient to produce all the accompanying clinical signs of shock. Experiment 18 is typical.

Experiment 18 March 8, 1915. Dog, weight 10,947 gms. 9:45 a.m. Etherized. Apparatus arranged to record carotid pressure and to bleed from femoral artery. Right vagus exposed. 9:55 a.m. Pulse 130, respiration 42, blood pressure 122. 9:58 a.m. Sectioned right vagus. Slight rise in blood pressure. 9:43 a.m. Stimulated central end right vagus for 10 seconds. Blood pressure increased 30. 9:45 a.m. Stimulated central end right vagus. Blood pressure increased 55. 9:50 a.m. Abdomen opened and viscera exposed, blood pressure gradually fell. 1:00 p.m. Animal has all the signs of shock. Has had no ether since 12:05. Eye reflex positive. Pulse 122, weak, respiration 18 gasping, blood pressure 70. 1:01 p.m. Stimulated central end right vagus 10 seconds. Blood pressure increased 36. 1:04 p.m. Stimulated central end of vagus 20 seconds. Blood pressure increased 40. 1:05 p.m. Blood pressure 70. Bled from femoral artery 260 gms. and 90 gms. from the heart. Estimated amount of blood was 942, 31 per cent was recovered from artery, 11 from the heart making a total of 42 per cent and leaving 58 per cent in the tissues (Fig. 4).

These experiments seem to prove that the reason for the common symptoms of shock and hemorrhage is that they have a common pathology. In shock a large percentage of blood is as effectually lost from the circula-

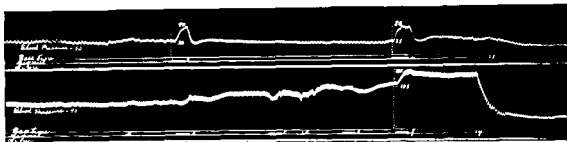


Fig 1 (Experiment 13) Normal blood pressure 95. Right and left vagus sectioned at *a* and *d*, respectively. At *b*, *c*, *e*, and *h* central end of right vagus stimulated. Central end of left vagus stimulated at *f* and *i*. At *g* the animal was bled 37 per cent of its blood. At *j* it was bled to death. Note the reaction of vasomotor center after hemorrhage.

tion as if it had escaped by a free hemorrhage. That this decrease in the amount of circulating blood is essentially different from the venous congestion produced by paralysis of the medullary vasomotor center is shown by a comparison between the amount of blood left in the tissues after section of the cervical cord and that after the production of shock. In the former condition there is only 10 per cent more blood left in the tissues than in the control, while in the latter there is a surplus of 37 per cent stagnated in the tissues.

However, these experiments do not preclude the possibility of the production of splanchnic paralysis by an inhibition of the cord centers as held by Janeway and Ewing (5). While it is true that vasomotor reflexes involving the cord-centers take place during shock, the following experiments show that the centers are not fatigued and that complete vasomotor paralysis does not produce immobilization of the blood. That the centers are active was shown by Experiment 125.

Experiment 125 February 20, 1914. Cat, female. Etherized. Blood pressure 98. Dorsal cord exposed and first segment sectioned, blood pressure fell until it reached a constant level of 70. Abdomen was then opened and viscera exposed. Blood pressure fell rather quickly to 42. When blood pressure was 14 and the animal in marked shock, a small probe was passed peripherally in the spinal canal, compressing the cord. Blood pressure quickly increased to 52.

That total destruction of the central vasomotor system does not produce the immobilization of the blood found in shock is shown by the following experiment.

Experiment 25 March 11, 1915. Dog, small brown female cur, weight 7,464 gms.

8 50 a.m. Etherized. Apparatus arranged to record carotid blood pressure and a cannula placed in the femoral artery. 9 00 a.m. Pulse 150, respiration 20, blood pressure 120. 9 05 a.m. Incision made to expose cervical cord. Cord laid bare, slight hemorrhage. 9 20 a.m. Ligature passed around cord. 9 22 a.m. Cord sectioned at sixth cervical segment, blood pressure 94. 9 35 a.m. Cord exposed in lower lumbar region. 9 50 a.m. Probe passed from cervical opening peripherally. Some little difficulty was experienced in keeping probe in canal. However the entire cord

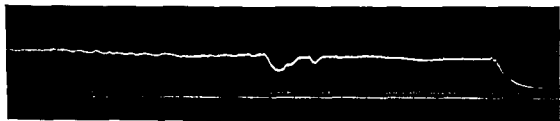


Fig 2 (Experiment 11) Normal blood pressure 145. Marked fall in pressure when ligature was passed around cord. After section of sixth cervical segment blood pressure remained at 100, 65 per cent of blood secured from femoral artery and 12 from heart.



Fig 3 (Experiment 26) Normal blood pressure 128. Began to push ether at *a*. Respiration failed at *b*. Femoral artery was opened and artificial respiration started at *c*. Obtained 148 per cent of blood from artery and 15 from heart. (Experiment 27) Normal blood pressure 102. Signals *a'*, *b'*, and *c'* signify same as in Experiment 26. Obtained 145 per cent of blood from artery and 15 from heart.

was finally destroyed from cervical opening to lumbar opening. There was some hemorrhage. At first the blood pressure was not markedly affected but the respiration became irregular and the blood pressure finally fell to zero. 10:20 a.m. Animal bled. Secured 250 gms of blood from femoral artery and 85 gms from heart. The estimated amount of blood was 574 gms, 42 per cent was obtained from the artery, 15 per cent from the heart making a total of 57 per cent and leaving 43 per cent in the tissues.

That loss of vasomotor tone with splanchnic congestion for the length of time necessary to produce shock does not give rise to identical conditions is shown by Experiment 41.

Experiment 41 March 29, 1915. Dog, male shepherd, weight 16,918 gms. 8:45 a.m. Etherized. Apparatus arranged to record carotid blood pressure. Cannula placed in femoral artery. 9:04 a.m. Blood pressure 145. 9:06 a.m. Incision made to expose cervical cord. 9:12 a.m. Passed ligature around cord. 9:18 a.m. Cord sectioned at sixth cervical segment, slight hemorrhage. Blood pressure fell to 60. Animal was kept lightly etherized until 11:30. Blood pressure at this time was 75. Femoral artery was opened obtaining 675 gms of

blood, 145 gms were obtained from the heart. The estimated amount of blood was 1,301 gms; 52 per cent was secured from artery and 11 per cent from the heart, making a total of 63 per cent and leaving 37 per cent in the tissues. This is practically the same result as in the cord series (Fig 5).

The following experiment shows that the immobilization of the blood in shock takes place beyond the control of the vasomotor system. This experiment also emphasizes the fact that the amount of blood obtained is not primarily dependent upon blood pressure.

Experiment 29 March 12, 1915. Dog, young brown female spinnel. Weight 5,971 gms. 2:50 p.m. Etherized. Carotid blood pressure taken. Cannula placed in right femoral artery, left femoral vein exposed. 3:00 p.m. Pulse 132, respiration 18, blood pressure 110. 3:13 p.m. Abdomen opened, viscera exposed. Marked fall of blood pressure which quickly recovered and was followed by a gradual fall. 4:20 a.m. Animal in moderate degree of shock has needed no ether since 4:00. Eye reflex positive, blood pressure 50. 4:23 a.m. Injected 2 cm of adrenalin (1:1000) into femoral vein. Blood pressure increased from 50 to 180. 4:24 a.m. When blood pressure had reached highest

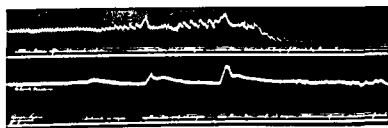


Fig 4 (Experiment 15) Normal blood pressure 122. After exposing viscera for three hours it had decreased to 70. Reaction of vasomotor center practically normal. Obtained 31 per cent of blood from artery and 11 from heart.



Fig 5 (Experiment 41). Normal blood pressure 145. Cervical cord exposed between *a* and *b*. Fall in blood pressure due to passing ligature around cord. Cord sectioned at sixth cervical segment at *c*. Blood pressure fell to 60 but after 2 5 hours increased to 75 when the femoral artery was opened (*d*). Obtained 52 per cent of blood from artery and 11 from heart.

point, the femoral artery was opened. Obtained 175 gms of blood from artery, 35 gms from the heart. The estimated amount of blood was 450 gms, of which 38 per cent was secured from the artery and 8 per cent from the heart, making a total of 46 per cent, leaving 54 per cent in the tissues. The maximum constriction of the arterioles in shock with an increase of blood pressure far above normal did not materially increase the amount of mobile blood as compared with the average of the shock series (Fig 6).

The following experiments show that considerable blood can be lost in both shock and hæmorrhage and still a relatively high blood pressure be maintained. The parallelism of the two conditions and the activity of the vasomotor system are again presented.

Experiment 30 March 13, 1915. Dog, black, white, and yellow female mongrel, weight 10,450 gms. 9 15 a.m. Etherized. Apparatus arranged to record carotid blood pressure and to bleed from femoral artery. Both vagi exposed. 9 30 a.m. Pulse 170, respiration 26, blood pressure 95. 9 34 a.m. Right vagus cut, slight rise in blood pressure. 9 35 a.m. Stimulated central end right vagus, respiration ceased, slight rise in blood pressure. 9 38 a.m. Repeated stimulation, same result. 9 40 a.m. Sectioned left vagus. 9 41 a.m. Stimulated central end right vagus, slight increase in blood pressure. 9 42 a.m. Stimulated central end of left vagus, blood pressure increased 35. 9 44 a.m. Blood pressure 150. Bled 205 gms (approximately 36.7 per cent) from femoral artery. Blood pressure fell to 35 and then gradually increased to 40. 10 00 a.m. Animal exhibited the signs of shock. Stimulated central end right vagus, blood pressure increased 40. 10 06 a.m. Stimulated central end left vagus, blood pressure increased 45. 10 08 a.m. Bled from femoral artery obtaining 200 gms of blood and 130 gms from heart. Estimated amount of blood

was 810, 61 per cent was the total amount from artery, 16 per cent from heart, making 77 per cent, leaving 23 per cent in the tissues.

The above experiment proves that a free hæmorrhage of 36.7 per cent of an animal's blood, which is the average found to be lost in the shock series, will produce all the clinical signs of shock and, furthermore, the vasomotor center response to reflex stimulation is identical in shock and in a hæmorrhage of this degree. A further comparison of these two experiments shows that shock and hæmorrhage have a common cause.

Experiment 19 March 8, 1915. Dog, male, white mongrel, weight 13,186 gms. 3 30 p.m. Etherized. Apparatus arranged to record carotid blood pressure and to bleed from femoral artery. Right vagus exposed. 3 40 p.m. Pulse 220, respiration 42, blood pressure 150. 3 50 p.m. Sectioned right vagus. 3 55 p.m.

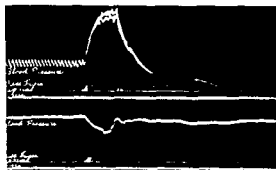


Fig 6 (Experiment 29). Normal blood pressure 110. Abdomen opened at *a*. When animal was in shock with blood pressure of 50, 2 ccm adrenalin was injected (*b*). Femoral artery opened at *c*. Obtained 38 per cent from artery and 8 from heart.

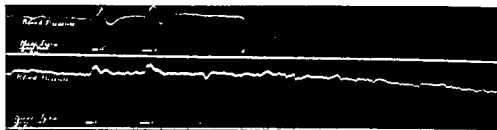


Fig 7 (Experiment 10) Normal blood pressure 150 Signals a and b, a' and b' mark point of stimulation of central end right vagus. Abdomen opened at c. After exposure of viscera blood pressure fell to 90 and animal did not exhibit all the signs of shock. Note reaction of vasomotor center, 38 per cent of blood secured from artery and 9 from heart.

Stimulated central end right vagus, blood pressure increased 30 3 56 p.m. Again stimulated central end of vagus, same result 3 57 p.m. Abdomen opened, viscera exposed, blood pressure gradually fell but animal did not develop all the signs of shock 6 00 p.m. Animal still requires an anæsthetic. Blood pressure 85 6 05 p.m. Stimulated central end of right vagus, blood pressure rose 4 6 06 p.m. Repeated stimulation, identical result 6 12 p.m. Blood pressure 90. Bled, obtaining 190 gms. of blood from artery and 95 gms. from heart. The estimated amount of blood was 1,014 gms., 38.4 per cent was secured from the artery and 9.4 per cent from the heart, making a total of 48 per cent and leaving 52 per cent in the tissues. This animal had lost physiologically 28 per cent of its blood and yet maintained a blood pressure of 90 and did not develop all the signs of shock (Fig 7).

Experiment 38 March 26, 1915 Dog weight 8,334 gms. 9 45 a.m. Etherized. Carotid blood pressure taken. Cannula placed in right femoral artery and left femoral vein 10 07 a.m. Blood pressure 130 10 10 a.m. Bled slowly 165 gms. (about 26 per cent) from femoral vein. Blood pressure remained at 110. Animal did not show signs of shock 10 54 a.m. Blood pressure 110, ether still necessary. Bled 64 gms. of blood from vein when cannula blocked by clot. Blood pressure 90. The left femoral artery was then opened and 46 gms. (about 7 per cent) obtained. Bleeding 220

gms. (about 36 per cent) of blood slowly from the femoral vein decreased blood pressure 31. Bleeding 46 gms. (about 7 per cent) from femoral artery decreased blood pressure 45 12 00 a.m. Animal exhibited signs of shock, bled 140 gms. from artery and 50 gms. from heart. The estimated amount of blood was 642. A total of 65 per cent was secured from artery and vein, 8 per cent from the heart making a total of 73 per cent leaving 27 per cent in the tissues (Fig 8).

Gatch (6) has shown that the abdominal wall is an important factor in the maintenance of the most efficient mechanism for the return of the blood to the heart. The bearing that this factor might have on the above method of investigation was tested in these experiments.

Experiment 31 The animal was given curare until respiratory movements had almost ceased thus eliminating the effect of abdominal tone before bleeding.

Experiment 37 The abdomen was widely opened just before bleeding was commenced.

In both these experiments the amount of blood secured was within the normal limits, showing that this factor did not complicate the results.

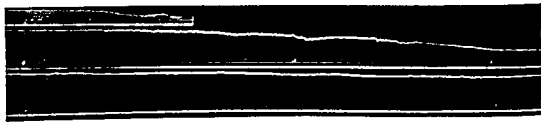


Fig 8 (Experiment 38) Normal blood pressure 130. Between a and b 26 per cent of the blood of the animal was removed by slow hemorrhage from femoral vein. Blood pressure decreased to 110. Between c and d 10 per cent more was removed. Between d and e bled 7 per cent from femoral artery. At f bled to death from femoral artery.

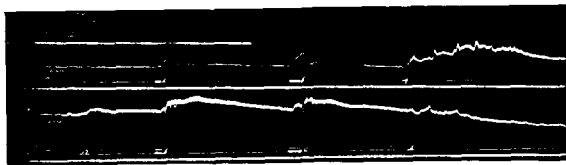


Fig 9 (Experiment 32) Normal blood pressure 100 Right vagus cut at *a* Central end stimulated at *b* and *c* Abdomen opened at *d* Blood pressure decreased to 30 Animal in deep shock when vagus was again stimulated at *e* and *f* Note reaction of vasomotor center At *g* injected 240 gms of citrated blood (equal to about 35 per cent of the animal's blood) Blood pressure at first increased, but in 30 minutes was only 64 Bled at *h*, obtaining 385 gms from artery and 63 from heart

Other experiments, as section of the splanchnic nerves, transfusion of blood, etc (Table I, Fig 9), further emphasized that there is a decrease in blood in shock and that this is not due to a primary failure of the vasomotor mechanism

SUMMARY OF EXPERIMENTS

The data from the experiments herewith reported may be summarized as follows

1 In a normal dog 66 per cent of the blood can be obtained from the femoral artery and 10 per cent from the heart, making a total of 76 per cent which can be secured, leaving 24 per cent in the tissues

2 In an animal in which the cervical cord is sectioned, producing medullary vasomotor paralysis, 54 per cent of the blood can be obtained from the femoral artery and 12 per cent from the heart, a total of 66 per cent, leaving 34 per cent in the tissues

3 In an animal in which blood pressure is depressed practically to zero by an overdose of ether, 46 per cent of the blood can be obtained from the femoral artery and 13 per cent from the heart, making a total of 59 per cent, leaving 41 per cent in the tissues

4 In an animal in which the viscera have been exposed until the clinical signs of shock are present but in which the vasomotor reflexes are as active or even more so than in the normal condition, only 28 per cent of the blood can be obtained from the femoral artery

and 11 per cent from the heart, making a total of 39 per cent, leaving 61 per cent in the tissues

CONCLUSIONS

The clinical signs of shock which appear after section of the abdomen and exposure of the viscera are due to a loss of circulatory fluid This loss of fluid is not dependent upon any primary impairment of the medullary vasomotor center and takes place at a point beyond the control of the vasomotor mechanism The causes for this loss of fluid are apparently the same as those which determine the accumulation of fluid in any other irritated area and produce the signs of inflammation The nervous system probably plays no greater part in the former case than in the latter The condition is made grave when the viscera are exposed because of the great vascularity of the tissues involved

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ADDENDA

BY JOSLPH C. BLOODGOOD, M.D., F.A.C.S., BALTIMORE

In *Progressive Medicine* for December 1914 (p. 169), I critically reviewed the contribution of Frank C. Mann¹ on "The Peripheral Origin of Surgical Shock." On December 8, 1914 Dr Mann wrote me as follows: "Your review of my article contains one criticism which I should like to answer by submitting further data and one misquotation to which, I am sure, your attention only needs to be called to secure its correction."

First, as to the correction. On page 170 of *Progressive Medicine* for December, 1914, I quoted from page 212 of Mann's article, his sixth conclusion. My quotation was as follows: "It is impossible to produce signs of shock by the use of excessive heat or cold." The quotation should have read "It is possible, etc."

On page 171 (*ibid.*) in quoting Mann's tenth conclusion I called attention to the discrepancy in his sixth conclusion. This mistake is mine.

Dr Mann further writes that on page 171 (*ibid.*) I wrote as follows: "In this paper the details of Mann's experiments are not given, so that it is impossible to study critically the methods of his investigation."

Dr Mann in his letter of December 8 tells me that in the original manuscript submitted to the Dean of the Medical Department of the University of Indiana, the experiments were given in detail but that the editor of the *Johns Hopkins Hospital Bulletin* was of the opinion that it was not necessary to publish them.

This criticism of mine, of course, amounted to very little. It simply meant that from the standpoint of pure physiology one would have been unable to follow Mann's experiments in the laboratory. The omission, however, cannot be blamed on Dr Mann. Similar experiments are described in detail in Dr Mann's paper in this issue.

Dr Mann further writes: "Concerning your other criticisms I must continue to regard them in the light of personal opinion until more data are submitted. I should like to point out, however, that the conclusions of Janeway and Fung are only slightly different from my own."

This experimental work of Mann was performed under the direction of Dr W. D. Gatch, Professor of Surgery of the Indiana University.

Dr Gatch also wrote me about my critical review in *Progressive Medicine*. "I was deeply interested as well as greatly surprised at your review of Dr Mann's article. I believe that if you had read the article more carefully instead of considering the conclusions entirely apart from the context, you would have agreed with most of the conclusions."

Dr Gatch writes as follows about Dr Mann's first conclusion, with which I differed in my critical

review: "It is impossible to reduce the anesthetized animal to a state of shock by any degree of sensory stimulation providing all hemorrhage is prevented and its abdomen not opened."

Bloodgood's criticism. "In my experience with operative surgery under general anesthesia in which the condition of the patient has been most carefully recorded and the blood pressure changes estimated during the entire operation, I have observed extreme degrees of shock in operations other than on the abdomen, even though there had been no hemorrhage, for example, during operation for old, badly united fractures of the shaft of the femur. In these cases the only factors which could have produced shock were the painful stripping of the periosteum and the extreme extension of the limb."

Dr Gatch remarks. "In regard to the first conclusion this is not new, in fact, Porter demonstrated it years ago. Mann demonstrated it beyond a shadow of doubt on fourteen dogs. In all of his cases the most extensive traumatization of the extremities was done: all four limbs being amputated and the limbs avulsed with as much roughness as possible. The skin was burned, the skull cap lifted and the dura cauterized. All of these manipulations were carried out within a period from four to six hours. The animals' blood pressure and respirations would show no change from that at the beginning of the experiments, being in as good condition as at the beginning. Of course the most scrupulous care was taken to prevent hemorrhage. It is interesting that in two cases in this series in which the signs of shock were developed, we found in one case a large intra-abdominal hemorrhage and in the other an enormous hemorrhage in the legs from fractured bones."

In my criticism as noted above of Mann's first conclusion I simply made the statement that my own clinical experience upon the human being could not confirm Mann's first conclusion.

I am not in a position to confirm or controvert Mann's experimental observations. I gather the impression, however, from what Dr Gatch writes me of Dr Mann's experience that this experimental work should rank with the best that has been done in the various experimental and physiological laboratories. But the very best experimental physiologists have come to different conclusions and apparently from data gathered from experiments as much alike as it is possible for the different experimenters to make them.

I feel that I must again record my disagreement with Mann's first conclusion based upon the evidence of his experimental work. It may be true for dogs, but it is apparently not true for the human being.

¹ Dr Mann writes me that all these experiments were done under ether and chloroform anesthesia.

I have observed extreme degrees of shock in operations in which the abdomen of the human patient had not been opened and in which there had been no hæmorrhage, that is, these patients have shown the same low blood pressure and the same symptoms which have been called shock when observed in operations upon the abdomen. I am also sure that the great majority of surgeons will agree with me.

My criticism, therefore, is not of Mann's experimental work, nor of his conclusions from the evidence of this laboratory investigation. I called attention to this conclusion, because I feared that it might create the impression that trauma in operations other than upon the abdomen was not an important factor in shock.

It is quite true that the same degree of shock experienced in operations on the abdomen is apparently much more serious than when observed in operations without the abdomen. It is also true, from my operative observations, that the prognosis of shock not associated with hæmorrhage is as a rule much better than of shock associated with hæmorrhage.

Among my records there is an anæsthetic chart which portrays an extreme degree of shock apparently due to an overdose of ether only, then a second chart recorded during a shoulder girdle amputation in which there was practically no hæmorrhage. The only etiological factors for the shock were ether anæsthesia and trauma.

The difference of opinion, therefore, between Dr Mann and myself is that my clinical observations do not confirm his first conclusion.

It is fortunate however that Dr Mann has taken up this physiological problem because there have never been enough well trained workers interested in it.

Dr Gatch remarks: "In regard to the observation of shock during the operation (upon the human being) there are so many causes by which the signs of shock can be produced and the term is used so loosely, that I have found it impossible nearly all ways to say just what was at fault in a given case. My belief is that the depth of narcosis has more to do with it than any other single factor. My reasons for this are set forth at length in a paper¹ entitled 'The Effect of Laparotomy upon the Circulation' and also in a paper soon to appear in the *American Journal of Surgery* on 'The Proper Depth of Narcosis.' Mann discusses this point at the beginning of his article and I am in complete accord with his conclusions that the word *shock* is used almost as vaguely as the word *rheumatism*. The gist of Mann's article is that shock and hæmorrhage are practically identical; that experimental shock is simply due to an extensive extravasation of the elements of blood into the peritoneal tissues; that this change is due to a traumatic inflammation and that the central nervous system has little to do with the condition. Of course we should use the most extreme care in handling the abdominal viscera.

Dr Am. Gwynne says: 1914.

This is not from the danger of nervous stimuli acting upon the central nervous system, but from the danger of traumatic inflammation in the peritoneal cavity."

Mann's conclusion 4: "The vasomotor center is not depressed nor fatigued. It is the most resistant of all vital centers. The peripheral and untraumatized visceral arteries are constricted in shock."

Bloodgood's criticism: "This must be a very difficult thing to prove or disprove. Crile has all ways favored the theory of fatigue or exhaustion, Meltzer inhibition, while Howell from his experiments, is of the opinion that there is more than one factor influencing this center. Apparently from the standpoint of pure physiology the exact relationship of the vasomotor center to shock seems still to be theoretical."

There also seems to be a difference of opinion among other contributors.

It is because of this difference of opinion that we can feel quite sure that the problem of the etiological factors of shock are by no means solved, and for this reason trained experimental surgeons such as Dr Mann are urgently needed and should be welcomed and aided and stimulated by wholesome and honest criticism.

The clinical surgeon whose day's work brings him into intimate contact with the problems of operative mortality and post-operative complications should endeavor to bring before the experimental surgeon his practical needs. Today, in surgery shock and infection are the most practical problems. The clinical surgeon needs help in both.

In the past many men have been of the opinion that research work in the various departments of universities has for its object simply the search for the unknown, irrespective of the needs of the community in which the university is situated. In recent years the universities which have apparently made the greatest progress have been those whose research laboratories have worked upon and solved problems helpful to the immediate needs of the people, for example the University of Wisconsin with its Department of Agriculture has brought forth the great development of scientific farming in the Northwest.

The laboratories of physiology in many of our universities have not as a rule been interested in solving the problems of the immediate need of the medical profession. Fortunately in recent years in some of the medical schools special departments of experimental surgery and physiology have been organized often independent of the older departments and in these new laboratories the workers have been chiefly interested in the investigation of problems of immediate practical importance to the practicing surgeon and physician.

In spite of the fact that physiologists have differed as to the exact etiological factors in shock their experimental work has been helpful to the surgeon in the recognition prevention and treatment of shock.

LEFT-SIDED APPENDICITIS

WITH THE REPORT OF A CASE AND CLASSIFICATION OF THE LITERATURE REPORTS

BY JOSEPH H. SCHRUP, M.D., DEBOLLE, IOWA

AN appendix on the left side without a transposition of viscera, while unusual, is not an infrequent condition, as the appended bibliography will disclose.

The X ray pictures here shown were taken of a patient I operated upon some months ago. In two of them the colon was injected with kaolin and shows a distinct angulation at the splenic flexure with the absence of a transverse colon, while the cæcum and ascending colon are in close apposition to the descending colon and sigmoid. The bismuth filled stomach and intestinal pictures were made to show the stomach in its normal position and the small intestines in the right side of the abdomen. The heart and liver were in their usual position and the patient was otherwise normal.

The diagnosis was ordinary progressive chronic appendicitis of five years' duration with early ovarian (cystic) and late gall-bladder (cholecystitis) involvement. There was a tenderness at McBurney's point, over the gall bladder and in both ovarian regions. The McBurney tenderness seemed as real as in the usual appendix case.

Incision disclosed the double cystic ovaries (each 4 cm. in diameter) but there was no appendix cæcum or ascending colon in the usual location. I noticed no omentum at any time during the operation. The jejunum was coiled up in the right half of the abdomen in the customary position of the cæcum and ascending colon. An endeavor to trace up the colon via the sigmoid disclosed the cæcum in that region just behind the sigmoid. The appendix was elongated and congested. There were no adhesions. The mesocolon seemed to have its attachment on the left side of the spinal column and the cæcum receded to that side when released from the right rectus incision. The usual appendectomy and repair of cystic ovaries resulted in a relief of all symptoms to date. The operation was performed March 10, 1914.

I must leave the reader to judge of the exact anatomical conditions present. I regret the absence of more details, but the

prolonged search for the appendix made a closer inspection of the exact anatomical conditions unjustifiable. The diagrams were post operative.

To determine the cause and frequency of the conditions found, I employed an expert to make a very thorough search of the literature, and, although I found no report of a case exactly like mine, a few were closely allied. These reports, together with the reports of other anomalous conditions of the colon that have a direct influence upon the position, relationship, and even condition of the oftentimes elusive vermiform appendix, I will take the liberty of reviewing in a general and comprehensive way, as I consider such a knowledge of these conditions to be indispensable in the every-day practice of the average practitioner.

To clarify the subject as much as possible, I will first give an anatomical classification and then an etiological classification. The former I have grouped under six headings, the latter under seven.

ANATOMICAL CLASSIFICATION

Left sided colons (resembling my case)

A case by Cabot (4) was similar to my case, except that the cæcum was loose in the abdomen and there was no definite ascending colon. Two cases by J. Reed (27), one his own, showed all of the colon on the left side, but the cæcum was high and there was coiling of all of the colon proximal to the splenic flexure. He states: "The malposition in both cases was the original formation of the parts and not the effect of the disease or any other agency."

Mr. Berry (3) reported a case as follows: "The cæcum with the ascending colon and the end of the ileum was turned up-side down and lay in the left side, being kept there by the mesentery."

J. Chiene (6) related a case, found in the dissecting room "in which the duodenum



Fig 1 Kaolin injected colon showing caecum and rectum to left of midline (Dr M Killeen)



Fig 2 Stomach in contraction to left of spinal column, small intestine to right. Colon not injected

passed upward into the right hypochondrium, and then, sweeping downward into the right lumbar region, became continuous with the jejunum without crossing from right to left in front of the aorta. Nineteen feet of coils of small intestines occupied the right and middle regions of the abdomen. The caecum was not lodged in the right iliac fossa, but lay loose in the cavity of the abdomen. The mesocaecum five inches broad, directly continuous with the mesentery, passed to the surface of the last lumbar vertebra. The colon, twisted on itself and not subdivided into an ascending and transverse portion, lay to the left of the middle line, and was continuous with the descending colon and sigmoid flexure which occupied their proper regions."

As will be noted, all of these cases were in the pre X ray period and so, of course, could have no confirmatory skiagrams as in my case.

Right sided colons Two cases of right-sided colons are reported. One is by Esquirol (10) in which the transverse colon, after making a sharp curve in the right hypochondrium descended perpendicularly in the middle line and entered the pelvis directly behind the pubis. The patient was an insane woman, age 28, who died from obstruction of the bowels. The other was reported by N. Dayabhu (9) wherein he related a case, found at autopsy, in which the descending colon

crossed obliquely downward from the splenic flexure to the caput coli in the right iliac fossa. From this point it turned straight across over the promontory of the sacrum to the left iliac fossa. Here it formed the sigmoid, which entered the pelvis normally.

Herniated colons Cabot (4) reported a congenital hernia of the large intestines into the transverse mesocolon.

E. W. Holmes (16) cites as follows: "R. H. Dawbarn of New York some years ago reported an autopsy in which, through a congenital opening in the left leaflet of the diaphragm, the intestine made its way into the left side of the thorax. The appendix was about two inches long and quite normal. It lay in contact with and partly in front of the pericardium. If this man had ever suffered appendicitis the pain would have been referred to the apex of the heart, or a little to the right of the apex."

T. Thompson (32) saw a male infant 15 months old, who died after an attack of pneumonia followed by pertussis. "On opening the abdomen only small intestines could be seen. The whole of the colon was found behind the small intestines, and the sigmoid flexure crossed into the right iliac region over the promontory of the sacrum, and there descended into the pelvis on the right side."

Of late (25) there have been some reported

There has been some B. E. J. (31) quotes cases with their a case of his own of the caecal end of the right pelvis and of the midline (given in an article in the One Hundred and The most im- excessively the pelvic floor the middle of the ab-

inches, and descending again to the right and joining the rectum. The whole colon measured six feet.

Complete transposition of the viscera. This is a complete transposition of the viscera the appendix would be expected on the left and the pre-operative diagnosis ought to be made in every case, as the usual general examination would disclose the heart on the right side and at once give the clew. A search of the literature of the last four or five years had disclosed some twenty six published cases of this sort. Their number in a few years compared with the number of other kinds of misplaced appendices reported during a period of one hundred years, makes it apparent that the latter condition must be very much more unusual than the former.

ETIOLOGICAL CLASSIFICATION

The explanation of most of the anomalous conditions found are fairly well summarized by the various authors. In a study of their own cases, often combined with the literature reports of others up to the time, and with the aid of embryology, they have come to some definite conclusion, as will be noted by the various appellation.

Non-rotation of colon. C. B. E. J. Nancrede (23), in the report of an operated case and partial review of the literature ascribes all unusual appendix positions to arrested rotation of the colon. E. M. Corner (8) in an article entitled "Fatal Case of Left Sided Appendicitis," says, "Clinically, it is frequent to find in children that the caecum and appendix have not reached the iliac fossa but have been delayed in their descent or become situated in the umbilical region. It is unusual for the left side of the abdomen or the pelvis to be reached. As a result of these abnormal positions, appendicitis in the young is commonly atypical, and it is necessary to rely on the generality that acute abdominal disease in children is probably appendicitis." V. Rawson (26), in an article entitled "Left Sided Appendicitis with Death from Preliminary Anaesthesia," says "The appendix was located to the left of the spine and was removed with great difficulty on account of a very short mesentery and due to

reported two cases of mal- such long me-en- be displaced to the One was in the the right lumbar the right lumbar colon in both

C. B. Lockwood (21). On Abnormalities of the Colon with Reference to the Appendix. He reports two of his own cases wherein he states that the appendix is displaced from its normal position in obscure and doubtful cases. The two cases were upon the right side, the appendix was nearer the spinal appendix. Both presented appendices epi-

V. S. (12) reported the following interesting conditions found at autopsy following an unsuccessful left lumbar colotomy: "There was a kink of the intestine, measuring one and one half inches from the pylorus. One portion, which was probably the small intestine, ended in a blind pouch. The other portion was of a smaller diameter, also ending in a blind sac from which sprang a rudimentary appendix and pipelike portion of gut terminating at the cul-de-sac forming the rectum."

J. M. Alexander (2) also reported a case of double colon in a boy, age 8. This case proves to be not a true double colon, as the little appendix, but a reduplication, ascending at the right of the descending colon eleven

non-rotation of the colon." LePlay (20) describes a subhepatic situation of the appendix in children due to incomplete rotation. A B Johnson (17) reports one case due to non-rotation, and writes that Dr George Brewer said that he had had a similar case. Dr Joseph A Blake said he had had two. Howard A Kelly (19) states "Abnormal positions of the appendix are caused by an abnormally long mesentery and by arrested foetal development. A long mesocolon may permit a complete shifting of the large intestines to the left side of the body. The excursions of such a movable ileocaecal apparatus make it possible for the appendix to be located in inguinal, femoral, and umbilical hernia."

Some classifications of arrested caecum and appendix positions have been attempted, as follows (a) outside of the abdomen, (b) within, close to the umbilicus, (c) in left hypochondrium (d) overdevelopment to right pelvis, (e) wandering caecum with long mesentery. One case was reported by Dr Hilton Fagge (11), in which the caecum was adherent to the sigmoid and omentum on the left side of the spinal column. J N Nicoll (24), under the title "Specimens from a Series of Thirteen Cases in Which the Vermiform Appendix Was Found on Operation in an Abnormal Site," groups the sites under the two general headings, extra-abdominally and intra-abdominally, as follows (1) extra-abdominally, (a) right or left inguinal hernias, (b) right femoral hernia, (c) umbilical hernia, (2) intra-abdominally, (a) under lower margin of liver, (b) left iliac fossa, (c) right subphrenic region, (d) Douglas' pouch.

Retention of foetal colonic mesentery. Some cases are reported of a persistence of all the original foetal colonic mesentery. One case by Mr Chuene (6), and a similar one by Morgagni (24), had only a descending mesocolon.

Mr Walshaw in *St Bartholomew's Hospital Reports*, vol XVI, described a case in which "the descending colon and caecum remained attached to the right border of the mesentery and had no attachment to the posterior wall of the abdomen." He states that "this is the usual state just before birth."

Elongated appendix. A. Garcia Casariego (5), reporting a prerenal case of Dr. F D Roldan's, and both a subhepatic and left iliac appendix for Dr F Busquent, asserts that these displacements are not all congenital, but that they may take place in the adult from laxity of ligaments, or an appendix may be so long that its apex is on the left.

Karemski (18) gives excessive length of the appendix as one of the causes of left-sided appendicitis in children.

O Schellong (29) describes a left iliac abscess case with death. Autopsy showed a long appendix running transversely back of the bladder to the left, with old peritonitic adhesions to the underlying tissues. Child had an appendicitis attack four months before with fever and pain for a few days.

Some years ago I reported a case (30) of an abscess in a girl 11 years old, which filled the left iliac region and extended up the left side as far as the left kidney. The abscess was opened in what was thought to be the center of the loop of the sigmoid to the left of the lower end of the left rectus, as the dullness was most superficial there. There was also a marked tumor and bulging per rectum. The patient eventually recovered. I saw her less than six months ago and she is now a big, healthy girl and says she has had no abdominal trouble since. She had had three distinct appendix (right sided) attacks in the sixteen months preceding the abscess. Each attack kept her in bed from one to three days. During three weeks preceding the evidence of the abscess there were varying signs and symptoms of the old right-sided appendix trouble. The right side cleared up immediately, however as soon as the left-sided evidences began.

At that time I thought, and in the light of this paper I still believe, that it must have been an elongated appendix which extended toward the left side and perforated at the tip. A skigram, however, would be necessary before positively ruling out any other abnormal anatomic intestinal relations, since there never was any intra abdominal inspection in this case. And, as will be remembered in the case of the cause of this article there was also only right-sided

McBurney pain and tenderness during the attacks

Fætal inflammations. J. B. Shober (31) theorizes: "Fætal inflammations cause adhesions and arrested development and turning of the colon."

Professor Flower (13) and Cleland (7) state that "a peritonitis occurring in fætal life by the formation of temporary or permanent adhesions could so modify development as to give rise to almost any deformity, arrest of development, or anomalous position"

Arrested descent of testicle and ovary According to Serres, Simpson, and G. St. Hilaire (15), "the position of the caput cæcum in the right iliac fossa is intimately connected with the descent of the testicle in the male and that of the ovary in the female" In those cases where the descent of the testicle has been arrested they have found that the cæcum also was arrested All of these coincident descents are normally complete at the fourth month

Adhesions H. Albrecht (1) examined the bodies of five hundred children under six years of age In 15 per cent he found anomalies of position due to congenital adhesions, and states that even as young as four to eight weeks of age anomalies in position are caused by adhesions

Other etiological conditions E. W. Holmes (16) described two post mortem cases, one incomplete rotation and the other no rotation at all He says "Conditions were due to results of intra-uterine inflammations, possibly syphilitic" A. B. Gloninger (14) cited two cases in his experience of subhepatic cæca in children 6 and 18 years of age who had been under very poor dietetic and laboring conditions, which he thought were displaced by the strain of their hard labor, and that the irritation of the cæcum by the poor food then caused them to adhere in this drawn up position

CONCLUSIONS

Modern methods of colon injection for diagnosis, and resection for therapeutic purposes, make this field most interesting and ought to disclose more of these anomalous conditions Most of the literature reports

I was able to obtain were made from post-mortem and dissecting-room findings, and some of these are more or less vague and indefinite.

There is no doubt in my mind that in the past many a life has been lost, and in the future many more will be sacrificed, because of the lack of knowledge of the vagaries of this much-diseased organ, either because of a failure in diagnosis, or because the proper diagnosis is not followed by the fortunate discovery, as in my case, of the fundamental source of disability.

DISCUSSION

John B. Murphy, Chicago "I have gone over your article on 'Left Sided Appendicitis' and the skiagrams for illustration It is certainly a good presentation of the subject, and should be of great importance to the profession, as many do not believe that the condition ever occurs, and consequently overlook it entirely, notwithstanding that anatomists have long known that the cæcum does remain on the left side continuous in the line of the original midgut"

E. W. Andrews, Chicago "The rarity of this anomaly makes the paper a valuable contribution The reported number of cases in literature are small I have reported several forms of appendicitis of the right side in former papers These are

"1 Transposition of the viscera, which of course alters the relations and brings the organ on the left side

"2 Excessive mobility of the cæcum, permitting it to become fixed on the opposite side of the abdomen

"3 The appearance of left sided tumor from the burrowing upward of a suppurating appendix located in the true pelvis, or from dumb-bell shaped abscess causing tumor on both sides simultaneously

"All these conditions are liable to cause mistakes in diagnosis and unexpected developments during operation"

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CONGENITAL INTESTINAL ANOMALIES

By MILTON G STURGIS, M D, F A C S, SEATTLE

CONGENITAL intestinal anomalies are of both anatomic and surgical interest. At first but the curiosities of the post mortem or the dissecting-room, later recognized at exploratory laparotomy, they are now occasionally distinguished prior to operation. A few years ago the diagnosis of congenital pyloric stenosis excited much comment such is now made frequently, showing that, though the condition is not more common, it is more readily and surely recognized. The diagnosis of appendicitis in the left iliac fossa, in the epigastrium, or immediately beneath the liver, is made, even though the condition be an infrequent one. Failure of the colon to rotate has been recognized prior to operation, and, with the increased use of X-ray bismuth pictures, both this and other anomalies will be more frequently diagnosed. They are readily divided into three classes: stenosis and atresia, diverticula and cysts, and malpositions.

Stenosis and atresia present a remarkable diversity of forms: diaphragms more or less

completely closed, complete membranes, strictures varying from those slight in degree to those which completely obliterate the intestinal lumen. Occasionally the continuity of the intestinal canal may be completely severed, the muscular layers passing smoothly around the blind ends. They occur most frequently in the duodenum—about 35 per cent of all cases recorded, occasionally in the jejunum and upper ileum, frequently in the lower ileum, where stenosis is found in the situation of Meckel's diverticulum, with which it is sometimes associated; and rarely in the colon. In the lower ileum, stenosis is not incompatible with long life, because of the fluid character of the intestinal contents.

In the duodenum, complete occlusion is much more frequent than stenosis—the most common sites being in the vicinity of the biliary papilla and at the duodenojejunal junction. This predominance is important because of the normal development of this particular portion of the intestine. In embryos of 7 mm it is a tubular structure bordered by epithelium two or three layers thick,



Fig. 1. Drawing of intestines after long immersion in preserving fluid. coils of jejunum (or ileum) to the obstruction were enormously distended at the time of birth.

which shortly begins to proliferate. Vacuoles are formed which completely block the lumen and divide the duodenum into two, or even three, separate cavities. This continues until the embryo has reached 14.5 mm. and is supposedly due to the resistance of the mesenchyma upon the expanding epithelium since the diameter of the duodenum increases slowly from 7 to 15 mm. but rapidly thereafter.

Atresia in the jejunum and ileum is quite rare. It does not occur in the process of normal development as in the duodenum and opinion is divided as to its cause—whether due to the persistence of developmental defect or to inflammatory causes—a prenatal peritonitis. In favor of this latter is the fact that meconium which does not fill the intestines until the fifth month has been found below a complete occlusion. It would seem, however, that if due to the latter there must be some dilatation below the point of occlusion. When there is no meconium we are warranted in believing the atresia to be due to the first-mentioned cause.

DIVERTICULA AND CYSTS

Diverticula are of two types—false and true. The false are protrusions of mucous membrane through the muscularis. These are found throughout the intestine, and are considered to be acquired usually in later life, yet similar protrusions have been described in embryos, and it is not improbable that these may be sometimes congenital.

Diverticuli whose walls correspond in structure to those of the normal intestine belong to the true type. There are but two—a diverticulum having at its apex an accessory pancreas, found in all portions of the intestine, and Meckel's diverticulum which is found in 2 per cent of humans in the lower ileum, on an average of 50 cm. from the ileocecal valve. Ordinarily a blind pouch 4 to 9 cm. long, on the free border of the gut, it may present a wonderful variety of form—a thumb-like projection, a patulous duct extending to the umbilicus or a fibrous cord interweaving among the intestines. With both attachments severed, it becomes the most prolific cause of congenital cysts. Its variable origin is made manifest in the sites of these—from one having been reported with in 4 cm. of the ileocecal valve. They may be found within the mesentery, and their contents may be clear, sanguinous, or chylous. Cysts also arise from snared-off portions of the intestines, cases having been reported arising from the duodenum and jejunum by both surgeons and embryologists. Cysts not connected with the development of the intestines, such as dermoids, and cysts from inclusions of portions of the wolffian duct are occasionally found in the mesentery and posterior peritoneum.

MAL DEVELOPMENTS AND MAL POSITIONS

The former while extremely uncommon are occasionally found. Cases of the absence of the caecum of the caecum and ascending colon and of the ileocecal valve, have been reported.

Perhaps the most striking of the mal positions is the complete transposition of the viscera—over three hundred cases having been reported. That this number will be greatly augmented seems probable, since

a prominent roentgenologist (1) from his own experience reports eight such cases, and but four of failure of the colon to rotate

The presence of a mesentery in those portions of the colon normally retroperitoneal, may give them a wide range of motion, and an appendix attached to a cæcum which has followed the usual course of development may be found to the left of the midline. Ordinarily, however, mal positions result from the failure of the intestines to follow fully the usual course of their development, with the arrest of some portion at some point short of the normal one

In embryos of 4.9 mm the intestine, a midline vertical tube connected to the spine by a fold of the peritoneum, bends vertically forward toward the junction with the vitelline duct. This slight bend increases and becomes the primary intestinal loop. In embryos of 7.5 mm the vitelline duct has become detached and is separated from it by a considerable interval. At this time there is noticed an abrupt enlargement of the tube, the *processus termitiformis*, which marks the boundary between the small and large intestine. It is wholly a ventral bulge, first appearing in embryos of 6.25 or 7 mm and from it develop the cæcum and appendix. In embryos of 9.4 mm the vitelline duct has disappeared, and the intestinal loop has rotated. The rotation develops as follows:

At first the primary intestinal loop is in the median plane. This loop begins to rotate until its plane is transverse, the superior half lying on the right side, the inferior (the large intestine) lying on the left. This progresses until the large intestine crosses the small intestine, the inferior half of the loop becoming the superior. At 10 mm, because of the rapidly augmenting liver-mass, the intestines begin to pass into the coelom in the cord — this movement is complete at 22.8 mm — where they remain until the embryo is about 30 mm, when the return movement begins. This latter is complete at 40 mm. The small intestines return to the abdomen in the sequence of the 6 primary coils, the upper part passing to the left hypochondriac region, the lower part with the cæcum toward the right hypochondriac region,



Fig 2 Case 2

the portion of the large gut that lay within the cord now being obliquely placed across the abdomen in front of the duodenum. The cæcum now lies beneath the liver on the right side, which position it retains until shortly after birth, when about the fourth month the sigmoid having become shorter the cæcum is pushed down toward the right iliac fossa, with corresponding lengthening of the ascending colon.

CASE 1 This baby was born after severe labor, necessitating forceps. After the head was born, the body was extricated only by strong traction on the shoulders combined with counter pressure on the fundus. The cause of the dystocia was found to be a greatly swollen belly. When being resuscitated it was noted that bile stained fluid flowed freely from the mouth. There was a plug of inspissated mucus protruding from the rectum. No meconium was passed in the first 24 hours. An examination gave the following findings: A full term baby, fairly well nourished, apparently normal excepting only a greatly distended, tense abdomen. Percussion over this, showed flatness, excepting over the epigastrium and at irregular intervals elsewhere. The white plug of inspissated mucus was still protruding from the rectum. A definite diagnosis of this unusual picture was not to be arrived at, although it was possible to rule out the

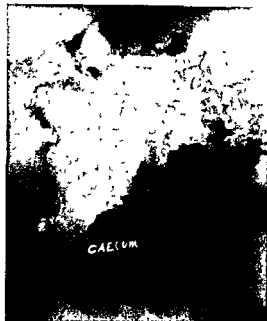


Fig 3 Case 2

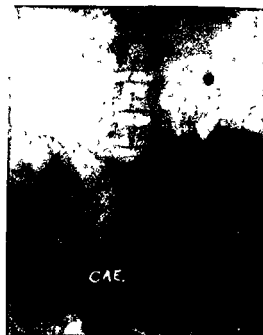


Fig 4 Case 2

kidneys and atresia of the rectum as possible causes, so, on consultation, operation was decided upon.

On opening the abdomen there was a gush of meconium stained fluid from the peritoneal cavity. The lower coils of jejunum, enormously enlarged, were found to be ruptured in several places. In lifting them the atresia was found, there being a complete severance of the lumen, the muscularis passing smoothly around the two ends. The serous covering in the form of a small fibrous cord connected them. Below, the ileum and colon were contracted on a core of inspissated mucus, their caliber being about equal to that of a lead pencil. It was not possible to anastomose at any point, and the lesion occurred so high in the small intestine that a fistulous opening had no possibilities. The abdomen was closed with drainage and the baby died some hours after. The post mortem showed no evidence of meconium below the atresia.

Cases of this sort are ordinarily brought only to the attention of the anatomist or the embryologist; but that they are sometimes brought to the surgeon is evidenced by the report of a case, similar in character, by Edwin Beer (2). The cases brought to the surgeon are those of complete atresia of the intestine, or stricture in the large intestine small enough to interfere with the passage of feces. The cases

having atresia rarely present an opportunity for surgical benefit, since, because of the peritoneal irritation which may be either primary or secondary there may be numerous bands of adhesions altering the normal anatomical relations rendering difficult surgical procedure. If the atresia occur anywhere in the intestinal canal other than low in the colon, surgical benefit is impossible, because the contracted caliber of the intestine below the lesion renders anastomosis impossible. Accordingly, the establishment of an artificial anus at such a point as not to interfere with the absorption of nourishment for the child is practically the only procedure. A stricture, however, as noted before, is not incompatible with long life when situated in the small intestine, and when situated in the colon usually does not give symptoms until the infant has gained considerably in resisting power, and these cases offer a fairly hopeful condition for the operator.

Figure 1 shows a drawing of the intestines after a long immersion in preserving fluid. The coils of jejunum cephalad to the obstruc-

tion were enormously distended at the time of birth.

CASE 2. Female 22 years. History of recurring gall stone colic. History otherwise unimportant, excepting chronic constipation. Operation disclosed pear-shaped gall stone with its stem in the cystic duct. Gall stone was removed. It was noted that there was no apparent transverse colon; that the foramen of Winslow was normally placed; that the duodenum covered with peritoneum could be seen directly under the omentum, and that the small intestine was on the right side. The omentum, a very thin lace-like structure, passed from the anterior surface of the stomach down over the small intestines. It was attached to the posterior wall along the right side and was apparently reflected forward over the anterior abdominal wall. There seemed to be a continuity of structure, digital examination showing no evidence of adhesion. The lower coils of small intestine were beyond the lower border of omentum, and lay free in the pelvis. The incision was extended and search was made for the transverse colon, which was discovered to the left of the umbilicus, and about 1.5 inches below. The cæcum, which was very large, was completely covered with peritoneum, and, without a mesentery, lay free in the pelvis. The ileocecal valve and the appendix were normally placed on the left side. The cæcum was readily pulled up into the wound. The appendix, which was short, thickened, and inflamed, was removed. It had a short mesentery. The ascending colon became retroperitoneal just to the left of the promontory of the sacrum, being very firmly fixed in this position, and emerging from the posterior peritoneum ascended to within 1.5 inches of the umbilicus, where it turned sharply and became what was thought at the time to be the descending colon, shown best in Fig. 4. The bismuth picture shows, in Fig. 3, that it again ascended to the splenic flexure, which was normally placed—a fact which was not ascertained at the time of operation. This abnormality, then, apparently has existed before the embryo was 7.5 mm long, without any appreciable symptoms other than chronic constipation—a complaint not unusual in the females.

The cases of non-rotation thus far reported have presumably never shown an omentum over the small intestines, there is no mention of such. Conversely, stress is laid on the fact that such a covering is absent; this being one of the marked diagnostic points. Its presence in this case raises an interesting question. Were the small intestines in an extension of the lesser peritoneal cavity which communicates with the larger through the foramen of Winslow as well as the extensive

opening into the pelvis? This was the conclusion we reached:

The lower edge of the omentum was fairly taut, and extended from the posterior surface of the right iliac fossa to the right side of the promontory of the sacrum; the anterior layer, passing over the colon, was attached to the left brim of the pelvis. To the left, the anterior peritoneal covering passed from the stomach down the transverse colon, from the colon to the brim of the pelvis. It had the appearance of the normal four-layer omentum. There was no further examination; the abdominal wound was closed and the patient returned to her room. Her convalescence was entirely normal.

Cases of non-rotation of the colon have been reported by Charles Mayo (3), Beekman Delatour (4), and William A. Downes (5). With regard to their occurrence and the occurrence of other intestinal anomalies, Charles Mayo sums up the situation very ably as follows: "The relative rarity of these obscure intra abdominal abnormalities and the fact that they so infrequently give rise to definite symptoms explain in part why a diagnosis is so seldom made when trouble occurs. However, within recent years the increase in the number of explorations for obscure abdominal conditions, and the enormous increase in operations performed on the intestine for a definite purpose, make it imperative that the surgeon should become familiar with anomalies of the abdominal contents, having in mind the possible conditions."

I wish to extend my thanks to Dr. William F. Whitney, of Boston, for his dissection in Case 1, to Mr. Aitkin for his excellent drawing of the same, and to Dr. Howard Snively, of Seattle, for his excellent X-rays of Case 2.

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FIBRIN AS A HÆMOSTATIC IN CEREBRAL SURGERY

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THE purpose of this paper is to suggest the use of fibrin for controlling hæmorrhage in certain types of intracranial surgery. Fibrin possesses all of the hæmostatic qualities of cotton wet with salt solution and has the advantage that it is absorbed with comparatively slight reaction on the part of the surrounding tissues. Fibrin is easily procured, it is inexpensive, and it may be kept sterile with the other operating room supplies.

During the extirpation of cerebral tumors there is occasionally more or less difficulty in controlling hæmorrhage. Troublesome bleeding is particularly liable to occur with new-growths which have deep, vascular pedicles or which have attachments to the walls of inaccessible dural sinuses. In an emergency of this sort the cavity is usually packed with some foreign substance, such as cotton, and moderate pressure made over the wound. When bleeding is started afresh by the removal of the cotton it is the custom of some operators to insert small pieces of muscle or fascia against the bleeding points and hold them in place until the oozing ceases. Cushing (2) and Horsley (5) have found fragments of raw muscle very helpful for this purpose and have noted no ill results to follow their use.

Various kinds of tissues are now recommended for hæmostasis. Hulse (4), Stuckey (8), Chessin (1), Philipowicz (7), and many others have reported successful autoplasmic hæmostasis in hæmorrhage from the abdominal viscera with slices of subcutaneous fat, pieces of omentum, and strips of fascia. Philipowicz asserts that this autoplasmic method has never failed to arrest hæmorrhage either in the clinic or in experiments when properly done. In abdominal work Ohkohchi (6) found disturbing adhesions to develop most frequently with slices of muscle. On the other hand, proliferation of connective tissue was most pronounced with peduncu-

lated omental flaps. All of the advantages of these tissues, he believes, can be secured, with none of their disadvantages, by using a slice of sea sponge. It arrests the bleeding mechanically; it is gradually absorbed; and it does not seem to irritate the surrounding tissues—minimal adhesions form later and the parenchyma of the organ does not degenerate. In intracranial surgery Wendel (9) has shown that comparatively large pieces of fascia and subcutaneous fat may safely be transplanted into cerebral defects.

While the methods which employ cotton, muscle, or fascia are usually successful in securing hæmostasis they possess certain obvious disadvantages. In the first place it is often difficult to procure a sufficient amount of fascia or muscle. Though other portions of the patient's body—the thigh for example—may afford an abundant supply of either tissue, the preparation of the leg and the excision of the muscle necessitate a certain delay. This procedure, furthermore, always contributes a slight additional chance for infection. In the second place, it occasionally happens that an inaccessible bleeding area can be controlled only by using a bulky packing material such as cotton. In the subsequent removal of this tampon it is often difficult to withdraw all of the cotton without stirring up fresh hæmorrhage. No operator, however, cares to leave an unabsorbable substance of this nature in the wound, in spite of the fact that animal experiments have shown a good tolerance of the cerebral tissues for cotton.

At the suggestion of Dr. Cushing the writer attempted to find an absorbable material which might be used for this purpose in place of cotton or muscle. The fibrin from sheep's blood ultimately proved to answer most of the requirements. Sheep's fibrin was used because it was readily procured from the Wassermann laboratory.

Serologists usually shake the freshly drawn

blood in a flask containing glass beads until the fibrin formation has been completed. The fibrin collects about the beads in a stringy, spongy mass. In this form it was received for the experiments outlined in this report.

After washing the fibrin repeatedly it is allowed to stand in distilled or tap water for twenty-four hours or longer—until all of the enmeshed red blood cells have been laked. This brings out the natural white color of the substance and prevents it from assuming a muddy appearance during the subsequent sterilization. After placing the fibrin (previously divided into smaller pieces) into a roomy glass jar containing normal salt solution, the mouth of the latter is covered with cotton and gauze and sterilized. The sterilization softens the fibrin and thus facilitates its absorption by the tissues. It is now ready for use. In this form the fibrin will keep for months.

Two sets of experiments were conducted on animals—dogs and cats. In the first the hæmostatic qualities of fibrin were investigated by using it in a variety of wounds, some with torn vessels and others with lacerations of the sinus walls. When dipped into a physiological salt solution and pressed against bleeding points with a sponge or a wisp of dry cotton, fibrin was found to control the hæmorrhage even better than wet cotton. The soft and pliable nature of this substance made it adhere to rough and smooth surfaces alike. While fibrin probably exerts no appreciable chemical influence on the process of coagulation it appears to possess some mechanical property favorable to the formation of a firm clot. The difference between fibrin and cotton in this respect was clearly shown when pledgets of each material were pressed over bleeding spots and then removed again after a lapse of a minute or two. Fibrin was found to adhere to the underlying structures much more firmly than cotton. This fact probably accounts for the more efficient hæmostasis noted with the former when larger vessels were dealt with.

Clotting may perhaps be hastened by dipping the pieces of fibrin into a solution such as the Kocher-Fonio coagulin (3).

More or less difficulty is frequently en-

countered in keeping a deeply placed fragment of fibrin in its proper position. In removing the gauze or cotton used to make pressure over the implant the former is apt to loosen or tear the pledget from its bed. A simple expedient found to meet this complication consisted of a ball or finger-shaped piece of dry cotton about which was wrapped a sheet of rubber protective tissue. The edges of the latter were secured at its base with thread. A pledget of fibrin was mounted on the smooth end by firmly squeezing a piece wet with salt solution against the protective. This form of applicator permitted ample pressure to be made on the implant without adhering to it or to the surrounding structures.

In the second series of experiments small pieces of fibrin were imbedded in the cerebral hemispheres of cats. After varying periods the animals were sacrificed and the implants with the surrounding cerebral tissues were examined histologically. The absorption of small blocks of muscle (autotransplants) was followed in a similar way.

About two weeks subsequent to the implantations, sections showed the results of the reaction usual for foreign bodies in general. Great numbers of leucocytes together with numerous new connective-tissue cells surrounded the alien material. Here and there slender new blood-vessels were seen penetrating into the mass. Occasional giant cells appeared near by.

When the animals were allowed to live four to five weeks the process of absorption was found much advanced. Of blocks of muscle tissue which originally measured nine to ten millimeters in all diameters only a few scattered fragments were visible. Implants of fibrin of a similar size appeared at the expiration of this time as a loose granulation tissue enclosing many leucocytes and a few areas suggesting hyaline degeneration. After the sixth week neither substance could be identified.

The reaction of the cerebral tissue was more marked to the muscle implants than it was to the pieces of fibrin. There were greater numbers of leucocytes present with the former and the exudate and granulation tissue extended farther into the enveloping

brain substance. This was most clearly seen while remnants of the foreign bodies were still perceptible. At a later period, six to seven weeks for pieces of the aforementioned proportions, only a small amount of scar tissue marked the sites of implantation of both materials.

The tolerance of the tissues for larger blocks of fibrin proved to be equally good. A piece which measured approximately three and one half by two by one and one-half centimeters produced no untoward clinical

effects and the same type of healing and absorption was discovered when the animal was subsequently sacrificed.

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ESSENTIAL UTERINE HEMORRHAGE¹

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THE importance to the economy of the ductless glands is now an accepted fact, and consequently many hypotheses have been developed to explain the relations of these glands to various important functions, which were previously either wrongly interpreted, or not at all explained.

Experimentally it has been demonstrated that the generative glands possess an internal secretion. Hegar (1) and Kehrler (2) have shown that castration in female animals resulted in atrophy of both internal and external genitals. Halban (3) transplanted ovaries under the skin of castrated animals, and in those instances in which the transplants took found that the atrophy was prevented. These experiments clearly proved that the ovaries possess a function that exerts a protective influence over the condition of the genitals and acts independently of the nervous system, in other words, a function chemical, or otherwise, acting through the blood stream. Knauer (4) also demonstrated the same fact, and Ribbert (5) and others proved that only a portion of the gland is necessary to maintain the normal condition of the genitals. These experiments demonstrated the existence of an ovarian internal secretion, but just which particular histolog-

ical structure or structures elaborated this secretion or secretions, if there be more than one, has not been definitely determined. The graafian follicle, the corpus luteum, and the so-called interstitial gland have all been suggested as the possible source.

Bischoff (6) in 1844 first suggested that the periodic maturation of the ovum and the subsequent rupture of the follicle caused menstruation. Recently this theory has been discredited and to the corpus luteum the important rôle has been assigned. Halban, to demonstrate the dependence of menstruation upon the presence of the ovary, transplanted the generative glands under the skin of castrated balloons who continued to menstruate so long as the transplants remained; when they were removed, however, menstruation ceased. Menstruation, in other words was dependent on the ovary but independent of the nervous system. What part of the ovary is the active one in this regard is still uncertain.

The graafian follicles are present at birth, undergo periodic growth and rupture, and persist even after the climacteric. These structures possess, in addition to their generative function, most probably other important secretory functions, and many writers are inclined to attribute some internal secretory

¹Work done under tenure of a George Blumenthal, Jr., Fellowship.

influence to the liquor folliculi. Just what rôle the graafian follicle plays in the actual production of menstruation cannot be determined, but in the light of recent investigations it would seem that it had little, if any, part in the direct causation, and that in all probability the corpus luteum is the important factor.

The corpus luteum comes into existence with the onset of puberty and menstruation, and persists, undergoing a cyclical change, until the advent of the menopause. Ruge (7) and R. Meyer (8) have recently shown that the corpus luteum passes through a rapid evolution, beginning with the rupture of the mature follicle about fourteen days before menstruation. The new gland formed from the changed granulosa epithelium has four histologically differentiated phases. These phases have a parallel in the cyclical changes that take place in the uterine mucosa as first described by Hitschman and Adler (9).

The first, or proliferation stage of the corpus luteum, corresponds in time to the interval phase of the mucosa. There is a dilatation of the vessels of the theca, with hæmorrhage and œdema between the cells. The theca cells increase in size while the granulosa cells become cylindrical and transformed into lutein cells.

The second, or vascularization stage, corresponds to the early premenstrual stage of the mucosa. Histologically, there is hæmorrhage from the dilated theca vessels between the granulosa cells and even into the lumen. There is an ingrowth of endothelium from the vessels of the theca forming new vessels between the lutein cells. These cells become larger and contain neutral fat. There is also a proliferation of connective tissue between the lutein cells. The lumen of the corpus luteum becomes vascularized and capillaries and fine connective-tissue cells cover the inner aspect of the lutein-cell mass.

The third stage, which is the full growth (Blüte), represents the completion of the vascularization and corresponds to the late premenstrual stage of the mucosa. Here the lutein-cell layer becomes definitely separated from the lumen by a capillary and connective tissue layer. The lutein cells

grow larger, become polygonal, and show an increased fat content. The lutein layer takes on a wavy, undulating outline.

The final, or regressive stage, corresponds to the menstrual and post-menstrual phase of the mucosa. This stage in the corpus luteum is characterized by a shrinkage of the lutein cells and an increase in the connective tissue between the cells. The blood-clot in the center becomes organized, the theca, which has grown gradually less marked, disappears.

Ruge and Meyer conclude that histologically the corpus luteum seems to be a gland of internal secretion whose greatest secretory activity takes place just before menstruation. Its activity is believed (Ruge) to cause the premenstrual change, and menstruation itself is supposed to be dependent upon it (Meyer).

Fraenkel (10) also classifies the corpus luteum as a gland of internal secretion and believes that it regulates the metabolism of the uterus. It causes the necessary changes in the mucosa for the reception and nidation of the ovum. If fertilization does not take place, the result of the change in the mucosa is menstruation.

Biedl (11), however, does not accept this theory and argues that menstruation may occur without ovulation and consequently independent of the corpus luteum (?).

It would seem, however, that the corpus luteum is concerned in the process of menstruation, for the inception of the menstrual function coincides chronologically with the appearance of the corpus luteum and the subsidence of this function coincides with the disappearance of the corpus luteum.

The third structure, the so-called interstitial gland, in the human species is a rather inconstant find. It has been described as composed of epithelioid cells which are arranged differently in the various species. Limon (12) demonstrated that it arises from the theca interna cells of atretic follicles. Fraenkel (10) believed that in the adult human species there are no such structures. Frank (13) in a careful study of many cases has only once found a structure which he believes can be interpreted as an interstitial gland. The writer has carefully studied the

ovaries removed in many diseased conditions and also normal post-mortem specimens, using special fat stains (sudan III, Sharlach R. and Nilblau), and has not been able to find any definite structures which correspond to the description of the interstitial gland in the human species or that resemble the structures so readily found in rabbits and guinea pigs Wallart (14) and Seitz (15), on the other hand, have found structures in human ovaries which they believe to correspond to the interstitial gland, so well developed in other species. These they find most marked at puberty, before menstruation, and during pregnancy, at the climacteric they cease to develop. These "glands" are supposed to have a secretory function, this hypothesis being based on the similarity in appearance between them and the cells of the adrenal cortex and also on the presence of fat granules and other cell inclusions, which are looked upon as evidence of secretory activity. Biedl (11) believes that the interstitial gland exercises a local influence on the physiological processes in the female generative organs, and especially upon menstruation. It would seem, however, that the interstitial gland cannot be assigned an important part in the production of menstruation. If the results of Wallart's investigations are accepted, we find these structures present in infancy and childhood, when no menstruation takes place, and also in pregnancy and in pathological conditions associated with pregnancy, as in hydatid mole and chorio-epithelioma.

An analysis of the various facts presented shows that the ovary is essential for the production of the changes in the uterus which result in the phenomenon of menstruation. The structures of the ovary that in all probability are the direct cause of this phenomenon are either the follicle or the corpus luteum, or both.

From the accepted fact that menstruation is dependent on the presence of the ovary and its secretion there naturally arose the supposition that irregular uterine bleeding was also dependent on the ovarian secretory activity.

Previously two great divisions in the types of pathological uterine hæmorrhage were

made: (1) those due to systemic conditions, as cardiac disease, anæmias, hæmorrhagic diatheses, diseases of liver and kidney, and (2) those due to local causes. The first group does not concern us in this communication. The second type has been further classified into (a) hæmorrhage due to demonstrable gross lesions, as tumors or inflammatory diseases of the uterus and adnexa, displacements, foreign bodies, and (b) those due to some histological changes in the uterine wall, vessels, or both. It is especially with this latter type that we will deal in this paper. This type of uterine hæmorrhage has a predilection for the two extremes of the sexual cycle, its inception, puberty, and its decline, the menopause. For a long time this condition was considered and treated as inflammatory. It was looked upon as a chronic metritis, whose most important symptom was hæmorrhage.

Scanzoni (16) in his monograph described a condition of chronic metritis which he divided into two stages: (1) that of infiltration characterized by a serous exudation into the tissues and marked hyperæmia; (2) that of induration, in which a relative anæmia of the uterine wall with dryness and increased hardness of the tissues, narrowing of the arterial and venous blood-vessels, and overproduction of connective tissue is found. He, however, made no microscopical examination. This condition was characterized by profuse hæmorrhage, the cause of which was believed to be congestive. The etiology of the chronic metritis was thought to be some circulatory disturbance due to menstrual anomalies, venereal excesses, masturbation, inflammation of the ovaries, or chronic diseases, as heart trouble, pulmonary disease, or anæmia.

Fritsch (17), after a careful study of operative material, most of which was obtained from tumor cases, however, concluded that a productive inflammation, with increase in the connective tissue and a marked passive hyperæmia, was the cause of the hæmorrhage. Most authors agreed that there was an increase of connective tissue in the wall of the uterus. Many looked on this as the result of a previous inflammation, and others as

the result of puerperal subinvolution and displacements. Again, some thought the primary lesion was a disease of the vessels which resulted in poor nutrition in the wall, with consequent fibrous replacement of the muscle and hyperæmia. The endometrium was also looked upon as the diseased area.

Olshausen (18) ascribed the hæmorrhage to a chronic infection of the uterine mucosa, to which he gave the name *Endometritis fungosa*, and which was characterized by marked thickening of the endometrium with preservation of the normal elements, though some of the glands showed dilatation. Ruge (19) agreed with Olshausen's views.

The first one to point out the probable influence of the ovary was Brennecke (20), who advanced the theory that the so called *Endometritis fungosa* of Olshausen was but the result of a chronic hyperæmia due to reflex nervous impulse from an ovary that is physiologically or pathologically changed, and therefore functions abnormally.

Reimcke (21), on the other hand, attributes the hæmorrhage to disease of the blood-vessels with coincident intramural connective tissue overgrowth. Chalmogeroff (22) found conditions similar to those described by Reimcke. The vessels showed a thickening of the media and adventitia with marked narrowing, almost obliteration, of the lumen. The vessels were devoid of the power of contractility.

Theilhaber (23) and his pupils Meier (24) and von Lorentz (25) in a series of articles take an entirely different viewpoint from that of previous writers. They believe, not that the mucous membrane and vessel changes are primary and that the increase in the size of the muscular wall and the connective tissue overgrowth are secondary, but that the contractility of the uterus is impaired by the interstitial tissue increase, and there results from this a venous congestion which causes the menorrhagia. In these papers the histopathology of the uterus was carefully described. The normal variations in the relative amounts of muscle and connective tissue and their relation to age and pregnancies were discussed. Theilhaber was the first to introduce the idea of lessened contractility as a cause of the hæmorrhage. He em-

phasized the fact that the increased connective tissue growth in the uterine wall or the weakening of the muscle might cause lessened contractility. He also described the thickening of the media and adventitia, but believed them to be physiological regressive changes after pregnancy. The change in the endometrium he considered of very slight importance. More recently he advanced the view that some abnormal function of the ovary influences the circulation in the uterus, and because of the defective muscular contractility, either from congenital or acquired weakness of the muscularis, or from fibrous overgrowth hæmorrhages result.

Pankow (26) in an exhaustive contribution shows that the changes both in the uterine wall and vessels could occur in women who had no abnormal bleeding, and that these changes were the result of regressive processes following pregnancy or menstruation. The ovaries in the bleeding cases present in many instances cystic changes, but nothing that could definitely be associated with the hæmorrhage. Similar ovarian changes were found in women who did not have pathological bleeding. He believed that some disturbed function of the ovary was the cause, but that histologically it could not be determined.

My own investigations were based on the study of twenty-five uteri, in eighteen instances with the adnexa, from patients on whom the diagnosis of "fibrosis uteri" had been made. The clinical pictures in these cases were strikingly uniform. The patients were all about the menopause period, the ages ranging between forty one and fifty two years, there being but two younger, one thirty one, the other thirty-five years of age. The chief complaint was that there had been marked menorrhagia varying from eight to twelve days in some cases since the first period, and that this symptom in the past year or so had become worse. Some of the women had occasional periods of metrorrhagia. Three of the patients had come into the hospital because of very profuse metrorrhagia dating back two or three weeks. All of the women but one were married, and all but this one had had several children.

The treatment in these cases had been conservative. They had received medical treatment of the usual kind, ergot, styptics, and general tonics, and some had had minor surgical operations, as curettage and cauterization of the endometrium without any permanent benefit. Some had shown temporary improvement, but the symptoms gradually recurred. None of the cases had been treated by the roentgen rays.

I also studied the uterus and adnexa of a young girl of fifteen who had had severe menorrhagia since the onset of menstruation, one year before, and who died from an intercurrent surgical condition. The uterus and adnexa were removed twelve hours after death. The other uteri were all operative material. Uteri of women of all ages from fourteen to sixty who had died from conditions other than gynecological, and in whom the menstrual history was normal, were used as controls. These uteri grossly showed no abnormalities nor did the adnexa.

The uteri from the bleeding cases showed variations in size from just below the normal, accepting 7 cm. as the average normal length, to those showing a definite increase. The smallest organ measured 6.5 cm. in length, the largest 11.5 cm. The wall also varied in thickness, in most instances being about 2.5 cm. (the average normal being 1 cm. to 1.5 cm. in thickness); in fact, only one case exceeded this. There were no gross lesions in any of the uteri or adnexa, either of inflammatory or neoplastic nature.

The consistence of the uterus in most of the cases was firm, more so than in the controls. Some few cases were slightly boggy, due to a moderate edema. The larger vessels in most instances stood out prominently above the cut surface.

For histological examination, wedges from various places in the uterine wall and also separate blocks of the endometrium, tubes, and ovaries were taken. The material was fixed in formalin and cut, some in celloidin and others in paraffin. The sections were stained with hematoxylin and eosin, Weigert elastic, Van Gieson polychrome, methylene blue, and some with Mallory's stains. Frozen sections were made of some of the ovaries

and stained with special fat stains (sudan III, Sharlach R. and Nilblau).

The various constituents of the uterine wall and adnexa were carefully studied to ascertain if there were any histological lesions constantly found in these uteri from bleeding women that were not found in the normal controls. In the mesometrium the connective tissue, the muscle, the elastic tissue, and the blood-vessels were studied.

It was almost uniformly found that the connective tissue was very prominent and in many instances comprised one half or more of the uterine wall. It appeared as broad strands between the muscle bundles and as fine fibrils between individual cells or groups of cells. Especially prominent was the disposition about the blood-vessels where the connective tissue was found arranged in swirls and whorls. It was seen that in the enlarged uteri with thickened walls the main bulk of the tissue was the fibrous element. In the sections stained by the Van Gieson method the zona vasculosa stood out as a brilliant red area.

In the uterus from a forty-eight-year-old virgin, which was the smallest organ in the series, there was only a slight increase in the amount of fibrous tissue, while in the uterus from the young girl of fifteen the amount of connective tissue did not seem to be excessive when compared with normal uteri at this age. In the control uteri from multiparae the arrangement and amount of connective tissue was similar to that found in the bleeding cases.

When we analyze our findings we must conclude that, while in practically all of our cases of bleeding there is a predominance of connective tissue, it cannot be looked upon as an etiological factor, for the same condition exists in the controls. The predominance of fibrous tissue is most marked in women who have borne children, and whether the numerous pregnancies with the consequent nutritional irregularities, slight trauma, and frequent involutions are the cause of the connective-tissue hyperplasia or not, it seems certain that the fibrosis with its secondary circulatory effects is not the main etiological factor to account for the bleeding.

The study of the musculature reveals no abnormalities. The relative amount of muscle depends entirely on the fibrous tissue content of the uterus. In the cases where there is an increase of fibrous tissue one finds a relative diminution in the muscle tissue, though occasionally in some of the larger uteri we find a well-developed muscular wall, and in addition a considerable increase in the fibrous tissue. In no case, however, could a lesion be found referable to the muscular tissue that could be held accountable for the hæmorrhage. In no instance could I determine a condition of myodegeneration as described by Theilhaber, or evidence of inflammatory involvement of the uterine wall as mentioned by other authors.

The elastic-tissue elements in the bleeding cases did not vary very much, either in arrangement or in amount, from that found in the controls. Pick (27) had shown that the elastic tissue was most abundant in the outer and middle muscular zones, the endometrium and muscularis just beneath the mucosa containing none. Pregnancy causes a marked increase in the amount, which condition persists even after the puerperium.

In the eleven multiparous cases there was considerable elastic tissue massed especially about the vessels and appearing as thick bands and large clumps and plaques. There were also numerous fibrils between the muscle bundles and running in the connective-tissue strands. The most marked amount was seen, however, in the zona vasculosa. Here the condition was similar to that described by Pankow (26), where the elastic tissue had fused, did not react to the special stains as well, and was described by him as elastoid. There arises, of course, the question as to whether these elastoid masses have the usual contractility and functionate as well as the fibrillar structures.

In the two virgin uteri there was very little elastic tissue about the vessels and scarcely any between the muscle bundles. When compared with the controls it was seen that the amount of elastic tissue seemed to be in direct proportion to the number of pregnancies that had occurred. Those women who had the greatest number of pregnancies

showed the greatest amount both around the vessels and in the myometrium. This condition persisted until the senile uteri were encountered, where there was a gradual replacement of the elastic tissue by fibrous tissue. The consideration of the occurrence, distribution, and type of the elastic tissue would show that it is entirely independent of the bleeding, and that it is dependent on the involution changes which follow pregnancy.

The vessels in the bleeding cases showed in most instances the following changes: The most striking feature was the marked thickening of the entire vessel-wall. The intima seemed not to be involved to any great extent and presented practically a normal appearance. The most advanced change was seen in the media, which contained enormous plaques and lamellæ of elastic tissue, some of which took on the peculiar appearance of the elastoid masses mentioned before. The musculature of the media was atrophic and presented areas of hyaline degeneration. There was also new connective tissue found both in and about the media and occasional areas of calcification were present. The adventitia was slightly thickened and showed an increase of both elastic and fibrous tissue. In the veins a similar condition was present but not so marked.

It was noted that those women who had borne children presented the most marked vascular changes. The women who had had no pregnancies showed less advanced lesions in the vessels and the young girl of fifteen showed normal vessels. The controls showed a condition similar to that found in the bleeding cases, the most marked changes being in those women who had borne children, while normal vessels were encountered in the uteri of children up to the period of puberty. The picture does not resemble the endarteritis of senility, though in some of the hæmorrhagic cases, as in the controls, a beginning atherosclerosis was present.

From a consideration of these findings we must conclude that the diseased vessels are not the cause of the bleeding and in fact do not always accompany it. It seems much more probable that the vessel changes are due to the uterine involution following re-

peated pregnancies or in a slight degree to the many years of menstruation with its oft-repeated miniature involutions

The study of the endometrium reveals an interesting picture. In practically every case we find a thickened, velvety mucosa, which histologically bears a resemblance to the premenstrual phase in the normal menstrual cycle. The glands are numerous, often tortuous, and many of them cystic, the latter condition seems to me to be rather characteristic for the mucosa of the bleeding cases. The stroma shows swelling and oedema of the cells and also a varying amount of interstitial oedema. In addition there is usually a moderate congestion with fairly marked dilatation of the veins. Occasionally there are round cells seen either singly or in groups, and scattered polynuclears and occasional plasma cells are encountered. This, however, is a normal condition (Geist, 28) and cannot be interpreted as a sign of inflammation. The entire picture suggests a circulatory disturbance and stimulation simulating the premenstrual change. Pankow (26) had described in many of his cases somewhat similar pictures and believed them to be due to the effect of the bleeding.

In the control cases these pictures were not present, and only in those where the menstrual cycle corresponded were the premenstrual changes found. Similar pictures were seen not infrequently in cases of fibromyomata, but these changes will be considered at another time.

An analysis of the above would lead us to believe that in this finding we have at least a definite morphological picture associated with this condition of hæmorrhage. The cystic dilatation of the glands is rather difficult of explanation. It may be explained partly on the ground that the interstitial oedema and close crowding of the glands leads to interference with the proper discharge of the glandular secretion and a consequent retention and cyst formation. The fluid in these cysts has the same staining reaction as that in the glands during the premenstrual phase, and the cells lining the cysts, though somewhat flattened, have the same morphological and tinctorial characters as

the epithelium of the glands during a normal premenstrual phase. In other words, the structures are normal glands whose function is mechanically interfered with.

The changed mucosa is not the cause of the bleeding but simply the result, probably of the same etiological factor, for even after a thorough curettage the bleeding often continues unabated, or, if it does cease, it returns before the mucosa can regenerate. Of course, there is a possibility that even a thorough curettage leaves sufficient mucosa intact to continue the hæmorrhage. Because of the striking resemblance between the mucosa of the bleeding cases and that seen in the premenstrual phase it seems natural to suppose that the same stimulus, perhaps slightly perverted or exaggerated in the pathological case, is the cause of the hypertrophy in both the normal premenstrual stage and in the abnormal bleeding condition.

Examination of the ovaries in these bleeding cases offers no solution. Grossly they present very little that is abnormal. They may be large succulent organs, but are often smaller than normal, sclerotic, and present in many instances numerous small cysts.

Histologically, the vessels show a slight sclerosis somewhat similar to that found in the uterus, but not nearly so advanced. This condition is most marked in women who have had several children. It was absent in the two cases in which no pregnancies had existed. The controls show the same condition, and we are led to believe that the vessel changes are due to the preexisting pregnancies and subsequent involutions.

The glandular structures in the ovaries show no striking changes. The follicles were not increased, in fact, they were in most instances very few in number, which might of course be accounted for by the age of the patient. There was no histological sign of hyperactivity, in fact, many were cystic and showed degeneration of the epithelium and disappearance of the ova. The structures representing the regressive processes, as corpora atretica and corpora albicantia, did not differ from those in the control. The corpora lutea histologically showed no definite cellular abnormality.

In some instances the ovaries were slightly enlarged and oedematous, which was due to a moderate congestion comparable to that seen in ovaries from women in the premenstrual phase of the menstrual cycle. These findings correspond somewhat with the cases described by Kaji (29), which, though not characteristic, are fairly constant. In other words, the ovaries showed no sign of hyperactivity, judging as we can from gross and histological examination. If one considered the follicles, the picture is that of a regressive change.

An analysis of the microscopical findings results in the conclusion that a definite histological lesion cannot be found to account for the profuse bleeding. Two lesions stand out as a constant accompanying factor: one the hyperplastic mucosa with its oedematous stroma and cystic glands, and the second the ovary with its cystic follicles and degeneration of the epithelium and ova.

The condition is surely not due to an inflammatory lesion of the myometrium with fibrous replacement of the destroyed muscle or to an acute or a chronic endometritis, for there are no signs histologically of such conditions. The enlargement of the uterus is due to the marked congestion and stasis, together with the moderate connective tissue hyperplasia that is often present.

The pathological bleeding comes on in the extremes of sexual activity: the beginning, puberty, and the end, menopause. Coincident with this are the periods of functional change in the ovary, in one the follicular activity, and in the other follicular regression. It would seem justified in assigning an important rôle in this condition to the ovary. Whether the condition in the ovary is entirely the cause or whether it is just one factor cannot at present be stated.

Mosbacher (30) found that in 80 per cent of the functional menorrhagias and metrorrhagias there was a vagotonic disposition, and in a majority of the cases of ovarian hypofunction, as in castrated women and those suffering from amenorrhœa, that a similar vagotonic disposition occurred. He does not, however, wish to conclude that these functional hæmorrhages are due to

a pure hypofunction of the ovary and suggests as a possibility a dysfunction as the cause. Adler (31) found an increase in the irritability of the autonomic system in cases of functional hæmorrhage, and in castrated women an increase in the sympathetic tone. He believes that the ovary has a depressor effect on the sympathetic system. From this he reasons that the increase in the irritability of the autonomic system in the cases of functional hæmorrhage is due to an excessive sympathetic depression, or, in other words, to the hyperfunction of the ovary.

Against a pure hypofunction of the ovary weighs the fact that removal of the ovary causes complete cessation of the bleeding, and also that X-ray sterilization leads to amenorrhœa. Against a pure hyperfunction is the fact that the condition arises in those periods when the function of the ovary is just being initiated or when it is on the decline.

The histological picture of the ovarian changes does not indicate a hyperactivity, rather the contrary. At puberty a few ripening follicles, often many cystic ones and others with degenerating epithelium, and in the older women a few normal follicles and numerous cystic and degenerated ones, are seen. To ascertain what part of the ovarian apparatus is at fault is rather difficult. We do know from experimental evidence that the X-ray affects the follicle apparatus and destroys it. We also know that the bleeding due to fibroids or the essential hæmorrhage can be absolutely controlled by raying. This would seem to imply that it is the follicle and its secretion, or some product of the follicle (*corpus luteum*), that is really at fault. It is a matter of common knowledge that insufficient raying causes an increase in the hæmorrhage and would lead us to suppose that the X-ray in these cases produces an abnormal function of the follicle either by stimulation, when not in sufficient strength to destroy, or by partial degeneration. In short, it would seem that in the ovary it is either the activity of the follicle or its product, the *corpus luteum*, that is the disturbing factor.

That the effect on the follicle may be in-

fluenced by the secretion of other endocrinous glands or that a disturbed balance between these glands may exist may be deduced from the recent work with organ extracts. Sehrt (32) showed that certain of these causes of essential bleeding can be absolutely controlled by the exhibition of thyroid extract, especially those cases occurring in young women. Fromme (33) has reported good results by the use of pituitary extracts in amenorrhœa, having caused profuse menstruation when previously there had been none. Recently Hofstaetter (34) has had very good results from the hypodermatic administration of pituitrin in the menorrhagias of puberty. Schultze (35) has reported fatal cases of metrorrhagia associated with adenoma of the hypophysis and aplasia of the thyroid. On the whole it would seem that there are variations in the etiology of the essential uterine hemorrhage, and that in some instances one gland like the ovary, thyroid, or pituitary may be at fault, supplying a secretion that is abnormal and so upsetting the balance of the entire endocrinous system.

Therapy in these cases will of necessity be individual, and only when we have advanced sufficiently to be able to classify the various types can we attempt to influence them by opotherapy.

I wish to thank Dr F. S. Mandlebaum, director of the laboratory, for the privilege of studying the material, and also to express my appreciation to Dr J. Brettauer and Dr. F. Krug for their kindness in allowing me the use of the clinical data.

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THE ABDERHALDEN REACTION IN MALIGNANT TUMORS, PREGNANCY, AND ANGIOSCLEROSIS

REPORT OF A YEAR'S WORK¹

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WHILE I was in Goettingen working on the problem of the transplantation of organs under Prof Hermann Stich, we succeeded in transplanting thyroids and spleens in dogs by the aid of blood-vessel suture. Our object was to determine a method of overcoming those biochemical differences in animals which are responsible for autolysis and the eventual absorption of the transplant. At the suggestion of Professor Stich, I went on to Halle to study under Professor Abderhalden his method of detecting protective ferments. Abderhalden proposed that we should begin by transplanting thyroid glands in dogs with a view of determining by dialysis which organs of the body were susceptible to insult following such transplantations.

I had brought to America a complete equipment for the test such as is used at the Halle Laboratory. The technique of the transplantations consisted in restoration of the normal circulation as far as possible by blood vessel suture. The details of these experiments were published in the *Annals of Surgery*, 1915. In an article published in *SURGERY, GYNECOLOGY AND OBSTETRICS*, December, 1914, we reported our first results in the diagnosis of malignancy with the Abderhalden test. A review of the literature of 1914 and the early part of 1915 shows many conflicting reports, and a critical glance at its contents seems advisable in view of the importance of the test for the early diagnosis of malignant tumors.

Boldt reports 43 cases of complicated pregnancy. In 28 the clinical diagnosis of pregnancy was made. The reaction was correct 27 times and incorrect once. In 6 cases the clinical diagnosis was doubtful and the reaction proved correct in 5 and wrong

in 1. None of these women were pregnant. In 6 other positively non-pregnant women, the Abderhalden reaction was weakly positive 4 times; in 1 the reaction was made just prior to menstruation. In 2 of the women the reaction was negative; that is, correct. In 3 cases extra-uterine pregnancy was suspected. The diagnosis in 2 of these was negated by the reaction, which proved correct. The third case was verified as having a tubal gestation in the course of abortion, but the reaction was negative. Boldt concluded that the Abderhalden test was no more than an aid to diagnosis, but in doubtful cases it was a very valuable aid.

Echols carried out the test on 95 women, 70 of whom were known to be pregnant. The pregnant women gave positive reactions. About 12 per cent of non-pregnant individuals gave positive reactions, including several patients just operated on for acute or chronic appendicitis, pus tubes, fibroids, and ovarian cysts. Echols concluded that the dialysis test for pregnancy was of value chiefly in a negative sense, that is, if a woman failed to give a positive reaction, she was not pregnant. If, on the other hand, she gave a positive reaction she was probably pregnant. Echols also criticized the use of parchment tubes or thimbles on the ground that their permeability to peptones and amino-acids became altered by boiling, which is the only method of sterilizing them properly.

Schwarz reported 41 cases known to be pregnant which gave positive reactions and 30 cases known to be not pregnant which gave negative reactions. Schwarz is a believer in the strict specificity of cancer and pregnancy ferments. In 5 cases of cancer examined, the cancer sera gave strong reactions with cancer albumin and faint re-

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actions with placental albumin; while the pregnant sera gave strong reactions with placental albumin, and weak reactions with cancer albumin. Schwarz ascribed the faint reactions to poorly prepared albumins.

Wohl concluded from his own 22 cases of pregnancy, in all of which a positive reaction was obtained, and from the review of all the literature up to the first of 1914, that the reaction for pregnancy stood on the same level as Wassermann's for syphilis; i.e., the reaction was positive in 80 to 90 per cent of the cases.

Wohl predicted a great future for the test for further research in pathology and therapeutics and cited 14 cases of epilepsy in which he found that cases which had progressed to the stage of dementia showed a ferment splitting up brain and testicle, serum of 2 of these cases showed cleavage of thyroid tissue as well. Furthermore, 3 patients who had had an attack a few hours before the blood was taken, reacted against brain and testicular tissue. He did not feel justified in drawing conclusions from the few cases he observed, but believes that Abderhalden's reactions will prove of great benefit in throwing more light upon the etiology as well as the prognosis of epilepsy. He also reported 2 cases of cancer in which the positive reaction was confirmed by operations.

Ball had correct reactions in 27 cases of tumors clinically or suspiciously malignant and in 22 non-malignant cases. There were three errors in positive reactions which Ball could not explain. He agreed with Frank and Heimann that certain pathological conditions such as myomata of the uterus, metritis and endometritis occasionally give a positive malignant reaction when not expected. Ball believes that poorly prepared substrata explained practically all of his erroneous findings, that bad thimbles came second, and that until further work perfected the technique, a clean-cut negative reaction carried much more weight than a positive one. Ball added that the association of this test with the bismuth meal and colonic injection made the strongest combination now at our command in the diagnosis of gastro-intestinal diseases.

Levin used adenocarcinoma of the breast tissue and obtained serum from 13 cases of carcinoma, 4 cases of sarcoma, 12 cases of pulmonary tuberculosis, and 8 cases of light nervous ailments. In the 13 carcinoma cases, 12 were positive and 1 negative. The sarcoma cases were all positive. Of the 12 tuberculous cases, 5 were positive and 7 negative, and of the last series, 4 were positive and 4 negative. Levin concluded that, while the test is more frequently positive in carcinoma, it could not be considered actually specific, since the same ferments seem to appear in the serum of non-carcinomatous individuals. He believed that the proteid substance which the ferments split up must be made to be more clearly specific and the test itself must be finer and not dependent on the behavior of the dialyzer. Levin finally remarked that for the present the method belongs to the research laboratory and not to the clinic.

R. St. Leger Brockman reported 25 cases of carcinoma and 20 cases in which carcinoma could be excluded beyond reasonable doubt. The test was positive in all 25 carcinoma cases and negative in the controls. One error in a control case was probably due to incubation lasting only 16 hours. Brockman believed his evidence sufficient to conclude that the test was specific for cancer.

J. Bauer had correct results in 8 carcinoma cases, but in 30 non-carcinomatous cases only half were negative. These cases were stomach patients with gastric ulcer and achylia gastrica. Bauer concluded that the technique of the test was insufficiently developed, but he believed that we are at the beginning of the rich harvest promised by the Abderhalden basic ferment theory.

Oeller and Stephan have constructed a new apparatus for the boiling of the dialysate to facilitate strict asepsis and to enable the worker to boil very rapidly a number of tests, obtaining at the same time an even boiling temperature.

Abderhalden in his Leyden lecture stated that the test was correct in 50 carcinoma cases and that sarcoma and carcinoma could be sharply distinguished. Abderhalden added that about 600 cases of pregnancy correctly

diagnosed by his test proved that only experimental errors lead to erroneous diagnoses.

Bornstein reported that he had positive results in 70 per cent of many of his carcinoma tests but in others only from 40 to 50 per cent. He concluded that if the reaction was positive, carcinoma is certainly present, but if it is negative the patient might nevertheless have a carcinoma. Bornstein thought that when the blood was pressed out of the preparation the greatest part of the cancer foci was also pressed out, and the preparation became too weak.

Mayer reported 18 carcinoma cases which had positive results, and gave his interesting experiments with the test on the ductless glands.

Oeller and Stephan attributed all errors to the dialyzers and their permeability, and required two tests for a positive result and several non-specific organ substrata for the specificity control.

De Waele found that thymol added to the serum and to the thimble wash aids in obtaining correct results.

Plant proved in experiments on 40 psychiatric cases that an increase of the proteolytic ferments in the dialysate could be caused by the presence of an organic, non proteolytic substance, and that this factor of absorption must be reckoned with as a possible source of error. This has also been pointed out by Abderhalden on page 190 of the third German edition of *Abwehrfermente*.

Epicum had 98 per cent correct results in 51 of his observations.

Kammerer, Clausz, and Dieterich had difficulties in their twelve series of experiments on ductless glands and carcinomata which they ascribe in great part to the inequality of the thimbles.

Singer in five series of experiments and in the verifications of the experiments of Hilner and Petri arrived at the conclusion that the strict specificity of the test has not yet been proved and that the dialysis method was not yet ready for general use.

Guggenheimer believed that the divergence of results of the different authors in respect to the specificity of the ferments in the carcinoma and organ diagnosis might be due to the

occasional factor of an associate destructive ferment and also to the ground tissue of the tumor, as occasionally uterus carcinoma might be digested by the serum of non-carcinomatous genitally diseased patients. Guggenheimer also pointed out that an organic injury involved secondary disorders of other organs, the functional disturbances of which are indicated by the presence of the corresponding serum ferments. He concluded, however, that the specificity was far-reaching.

Allmann had success in pregnancy diagnosis but dubious results in 12 carcinoma cases.

Hermann and Fritsch reported 34 reactions in carcinomata which were afterward proved by histological tests. They believed that when the Abderhalden test is perfected in technique and that with the exclusion of undesirable material a carcinoma might even be diagnosed from two to three weeks before its beginning, and thus the carcinoma prognosis might be rendered immeasurably more favorable.

Ball reported 51 cases. Of the 6 cases clinically malignant the reaction was positive. Of the suspiciously malignant conditions examined, 20 of the 28 gave positive reactions, which were verified by roentgenograms in 3 persons, post operative microscopical section in 10 instances, and definite subsequent histories in 7 cases.

Benech had correct results in 20 cancerous cases and 25 control cases.

Csèpai attributed his unsatisfactory results to errors in technique, especially to faulty thimbles, and believed that the test had great value especially in the diagnosis of disorders of internal secretion.

Lampe and Paregger pointed out that the substrata must be prepared, tested, and handled with the greatest care and that the verdict as to the specificity of the ferments depends entirely upon them.

Fritsch believed that the carcinoma test will only be reliable in the hands of experienced investigators working in a large laboratory.

Berghausen had successful reactions in 41 tests, except that the serum of 2 patients suffering from carcinoma of the uterus failed to digest placental tissue and that the serum of 1 pregnant woman failed to digest epitheli-

ABDFRIALDEN REACTION IN CANCER

Case Number	Referred By	Cen Serum each Test	Time of Day (hr)	Serum Centrif	Serum + Lactinoma	Serum + Sarcoma	Serum + Placenta	Serum + Uterus	Serum + Vagina	Serum + Adrenal	Serum + Large Gut	Clinical Diagnosis	Remarks
D 10	Dr M Fehberg	1.5	15	0	+	0						Recurrent carcinoma breast	Adenocarcinoma.
M 11	Montefiore Hosp.	1.5	15	0	+	0						Carcinoma intestines	Post-mortem.
M 12	Montefiore Hosp.	1.0	30	0	+	0						Carcinoma breast	Adenocarcinoma.
M 13	Montefiore Hosp.	1.0	15	0	0	+++						Retropertoneal sarcoma	Post-mortem.
B 14	Dr L J Ladouski	1.5	15	0	+	0	0					General carcinomatous	Marked cachexia.
B 15	Dr C Goodman	1.5	30	0	+++	0						Tumor abdomen	Uterocarcinoma, stomach op.
B 16	Dr C Goodman	1.0	16	0	0	+						Sarcoma testes	Hydrocele fluid.
B 17	Dr A A Himmowich	1.5	20	0	++	0	0					Carcinoma liver	Refused exploration.
M 18	Montefiore Hosp.	1.0	24	0	0	+						Sarcoma femur	Section typical.
M 19	Montefiore Hosp.	1.5	24	0	0	0	+					Carcinoma uterus (?)	+ Wassermann.
M 20	Montefiore Hosp.	1.0	24	0	+	0	0					Carcinoma breast	Operated.
M 21	Montefiore Hosp.	1.5	24	0	0	++						Retropertoneal sarcoma	Ascitic fluid, post mortem.
M 22	Montefiore Hosp.	1.5	16	0	0	+		0				Retropertoneal sarcoma	Blod serum.
P 1	Dr C Goodman	1.0	24	0	+	0						Post-op carcinoma breast	4 years no recurrence.
P 2	Dr C Goodman	1.5	20	0	+	0						Recurrent carcinoma breast	Adenocarcinoma.
B 41	Dr R Lewinohn	1.0	18	0	+	0						Carcinoma stomach and liver	Operated.
P 3	Dr L Friedman	1.0	20	0	++	0		0				Carcinoma stomach	Operated.
B 42	Dr A A Himmowich	1.0	24	0	+	0						Carcinoma stomach	Refused operation.
M 53	Montefiore Hosp.	1.5	20	0	+	0				+		Carcinoma recti	Post mortem.
M 54	Montefiore Hosp.	1.0	24	0	+	0						Carcinoma liver	Post mortem.
P 4	Dr C Goodman	1.5	20	0	+	0						Carcinoma stomach	Operated.
B 45	Dr L J Ladouski	1.5	16	0	+	0						Carcinoma breast	Operated.
B 46	Dr D Robinson	1.0	24	0	+	0						Carcinoma liver	Refused operation.
B 47	Dr C Goodman	1.5	24	0	+	0						Carcinoma recti	Refused operation.
B 50	Dr C Goodman	1.0	24	0	0	0						Carcinoma breast	Operated.
M 55	Montefiore Hosp.	1.0	24	0	+	0						Carcinoma liver	Ascitic fluid post mortem.
B 51	Dr C Goodman	1.5	24	0	+	0	+					Carcinoma stomach	Refused operation.
B 52	Dr A A Himmowich	1.5	24	0	++	0		0				Carcinoma stomach	Operation.
D 53	Dr C Goodman	1.5	24	0	++	0	+					Carcinoma stomach	Operation.
B 54	Dr A A Himmowich	1.5	24	0	++	0		0				Carcinoma stomach	Operation.
B 55	Dr D Robinson	1.5	24	0	+	0						Carcinoma stomach	Operation.
B 57	Dr D Robinson	1.0	24	0	++	0						Carcinoma pancreas	Marked jaundice refused operation.
P 5	Dr L J Ladouski	1.0	18	0	+	0	0					Carcinoma recti	Operation.
V 101	Dr G D Stewart	1.0	24	0	+	0						Carcinoma cervix	Post-operative 7 1/2 years.
V 102	Dr G D Stewart	1.0	24	0	+	0						Carcinoma stomach	Post-operative.
V 103	Dr G D Stewart	1.0	24	0	0	0						Tumor breast	Age 61 years mass in breast.
B 104	Dr G A Friedman	1.0	24	0	+	0						Carcinoma stomach	Post-operative.
B 105	Dr L B Meyer	1.0	24	0	+	0						Carcinoma liver	Post-operative.

ABDERHALDEN REACTION IN CANCER—Continued

Case Number	Referred By	Cen. Serum each Test	Time of Dialysis (hrs.)	Serum Control	Serum + Lactinoma	Serum + Sarcoma	Serum + Liver	Serum + Stomach	Serum + Artery	Serum + Lungs	Serum + Adrenal	Serum + Large Gut	Clinical Diagnosis	Remarks
V 106	Dr G D Stewart	1 0	24	0	+++	0							Carcinoma pancreas	Clinically
V 107	Dr G D Stewart	1 0	24	0	+	0							Carcinoma breast	Recurrence
M 111	Montefiore Hosp	1 5	16	0	++								Carcinoma recti	Adenocarcinoma
P 112	Dr J T Lynch	1 5	16	0	+							+	Carcinoma stomach	Under observation
M 113	Montefiore Hosp	1 5	45	0	0	+++							Multiple myeloma	Bence Jones Albuminuria
B 114	Dr A A Hummrich	1 5	45	0		+							Retroperitoneal sarcoma	Clinically
B 115	Dr A A Hummrich	1 0	24	0	+	0						0	Carcinoma lungs	Post-mortem
P 117	Dr J T Lynch	1 5	15	0	+	0							Carcinoma stomach	Same as No P 112
P 118	Dr C Goodman	1 0	24	0	+	0						+	Carcinoma recti	Operated
U 120	Dr G D Stewart	1 0	15	0	+	0							Carcinoma large gut	Clinically and X ray
P 122	Dr J T Lynch	1 0	15	0	+	0						+	Carcinoma stomach	Under observation
B 123	Dr H M Silver	1 0	15	0	+	0							Carcinoma stomach	Operated
U 124	Dr G D Stewart	1 0	17	0	0	0							Epithelioma oesophagus	Substrate adenocarcinoma
U 125	Dr G D Stewart	1 0	17	0	+								Carcinoma caecum	Operated
U 126	Dr G D Stewart	1 0	1	0	+								Carcinoma caecum	Recurrence
U 127	Dr G D Stewart	1 0	17	0	+								Carcinoma pancreas	Operated
U 134	Dr G D Stewart	1 5	24	0	+	0						0	Carcinoma lip	Operated
B 136	Dr C Goodman	1 0	24	0	0	+							Endothelioma larynx	Recurrence
P 137	Dr L Friedman	1 0	24	0	+								Carcinoma uterus	Post-operative
P 139	Dr L Friedman	1 0	24	0	+	0							Carcinoma cervix	Post-operative
B 142	Dr C Goodman	1 0	24	0	+	0							Carcinoma recti	Post-operative
B 143	Dr D Robinson	1 0	24	0	0	+							Sarcoma glands	Typical pathology
B 145	Dr L J Ladinski	1 0	24	0	+	0							General carcinomatous	Clinically
U 146	Dr G D Stewart	1 5	18	0	+	0							Abdominal tumor	Under observation
B 150	Dr Isadore Seff	1 5	24	0	+	0						++	Carcinoma liver	Operation
B 151	Dr Isadore Seff	1 5	24	0	+++	0							Carcinoma bladder	Inoperable cystoscopy

oma tissue, while that of another digested it Oettinger, Tressinger, and Pierre Marie reported that in their 63 cases the reaction was positive in two thirds of the cancer cases and negative in one-third. In the non-cancerous affections the reaction was positive in one third of the cases and negative in two-thirds. The authors concluded that the test was only very little, if at all, superior to the other laboratory methods.

Bisgaard and Korsbjerg did not consider the ninhydrin method delicate enough to ascertain the protease action and reported unsatisfactory results from their experiments.

Fritsch remarked that when a number of

parallel tests were made, the possibility of errors from the thimbles was of course decreased, but holds to his original opinion that the test may be used only as an adjunct.

Keitler and Lindner proved that exposure to X-rays has a retarding influence on the formation of ferments in animal experiments.

Schumkowa-Trubina found that the test was positive in about 95 per cent of the cancer cases, and the greater the homology between the substrate and the tumor of the case tested, the more frequent were the successful results.

Otto and Blumenthal had conflicting results and did not think the test was suitable for clinical purposes.

Parodi and Vidoni had conflicting results, and were extremely pessimistic as to the specificity of the test for pregnancy or for malignancy.

Gavrinsky believed that the negative results of the test in suspected malignancy spoke strongly against the existence of such conditions.

Biehn reported that the results of his experiments on animals regarding the protective ferments had borne out Abderhalden's statements as to their specific nature. He believed that greater reserve in reporting successful results was necessary and that we demand too much of the test, forgetting that all laboratory findings must be taken only as additional symptoms that serve to confirm or deny the other clinical signs.

Falls agreed in the main with Biehn's opinion of the value of the test as corroborative evidence, but was more pessimistic.

We are inclined to believe that a part of the unsuccessful results obtained by the authors should be ascribed to technical errors. In some of the instances these have been caused by poorly directed efforts to simplify an intricate and delicate technique even before the workers have mastered the test as described by Abderhalden in his book, *Abwehrfermente des tierischen Organismus*, 1913, which has now been translated into English.

In our work during the past twelve months the results have been more uniformly in accord with the research at the Halle Laboratory of Professor Abderhalden. We have made in all 334 dialysis tests, and of this number 27 were discarded because the blood was contaminated or else was withdrawn too soon after eating.

In cancer we have examined the blood of 64 patients. We obtained positive reactions in 58. In all of the 58 cases the positive diagnosis of malignancy was confirmed later by clinical, operative, or post-mortem evidence. Of the remaining 6 cases, 3 are still under observation.

We believe that the Abderhalden dialysis reaction as a corroborative test for malignancy has equal importance with any of the other recognized clinical laboratory methods of serum diagnosis.

We desire to repeat with emphasis that negative results are even more valuable than positive results.¹ To verify our positive findings and avoid discrepancies we invariably used a thimble containing serum alone. A positive reaction with ninhydrin in the control dialysate was attributed to errors in our technique, which arose either from contamination while the specimen was being obtained or in the handling of the thimbles. These were therefore discarded. We did not use blow wash bottles on account of the danger of contamination from saliva, as saliva gives a positive reaction with ninhydrin in parts of 1:1,000,000 (Abderhalden).

Our cases of malignancy consisted of the following: 16 with carcinoma of the stomach; 9 with carcinoma of the breast, 10 with carcinoma of the intestines; 6 with carcinoma of the liver, 4 with carcinoma of the uterus, 3 with carcinoma of the head of the pancreas, 1 with carcinoma of the lungs, 2 with general carcinomatosis, 1 with epithelioma of the lip; 1 with carcinoma of the bladder, 1 with multiple myelomata; 1 with an abdominal tumor, 1 with carcinoma of the esophagus, 1 with endothelioma of the larynx, 4 with retroperitoneal sarcoma, 1 with sarcoma of the testis, 1 with sarcoma of the femur; and 1 with sarcoma of the cervical glands. Of these cases, No B 16, a hydrocele of the tunica vaginalis, was diagnosed as a sarcoma; No B 50, a positive case of carcinoma of the breast, and No U 124, an epithelioma of the esophagus, were diagnosed as negative.

In a large series of pregnancy tests, the results were uniformly satisfactory. In order to illustrate the value of the test as a factor in determining the course of procedure where the usual clinical symptoms were not sufficient to form definite conclusions, we add the details of the following cases.

In No P 72, a multipara, age 39, her last pregnancy 17 years before, menstruation was regular until last menses six weeks prior to the examination which revealed a pelvic hæmatocele. The Abderhalden reaction was positive with placenta.

In patient No P 71, a woman about 20 years old, primipara, pregnant three

¹ Surg. Gynec. & Obst. 1914, LIX 797

PREGNANCY WITH COMPLICATIONS

Case Number	Ccm Serum (Each Test)	Time of Dialysis (Hours)	Serum Control	Serum + Placenta	Serum + Thyroid	Serum + Stomach	Serum + Pancreas	Stage of Pregnancy	Remarks
P 71	10	20	0	+	+		0	Third month	With glycosuria
P 72	10	20	0	+++				Ten weeks	
D 73	15	18	0	+		0		Fifth month	Nausea and vomiting
D 74	15	24	0	++		+			With pulmonary tuberculosis
P 75	10	24	0	++					

ANGIOSCLEROSIS

Case Number	Ccm Serum (Each Test)	Time of Dialysis (Hours)	Serum Control	Serum + Artery	Serum + Brain	Serum + Adrenal	Chaucal Diagnosis	Remarks
B 260	10	24	0	0	0		Tertiary hues cerebral complications	
M 261	10	24	0	+	0		Paralysis agitata, arteriosclerosis	Blood pressure 190
M 262	10	20	0	++	0		Arteriosclerosis	Age 74
B 263	15	24	0	+++		0	Angiosclerosis	One year after arteriovenous anastomosis Placenta and serum also negative
B 264	15	18	0	+++		+++	Angiosclerosis	Post-operative
B 265	10	18	0	+	0	++	Angiosclerosis	Post-operative
M 266	15	24	0	++			Arteriosclerosis	Hemiplegia
P 267	15	24	0	++		++	Angiosclerosis	Post-operative

months, the urine showed marked traces of glucose. An Abderhalden test gave a positive reaction with placenta and thyroid and a negative one with pancreas. Glycosuria disappeared at the termination of pregnancy.

Patient No. P 73, an interesting case at the Presbyterian Hospital, was a young woman on whom left nephrectomy for renal tuberculosis had been performed by Dr. Blake at the Presbyterian Hospital prior to her marriage. After 18 months, the surgeons were of the opinion that she might safely marry, provided she had no children. A guinea pig injected with a catheterized specimen of her urine remained well for two months and at autopsy showed no tubercular lesions. Ten months after marriage, she went to see Dr. Whipple in regard to her menses, which she had noted were two weeks late. Two weeks later she developed morning nausea. At this time her urine contained more albumin than usual and there was a considerable amount of pus and blood. A week later, pelvic examination revealed no positive signs nor did her breasts show any changes of pregnancy. We then

made an Abderhalden test with placenta substrate which was positive. As it was necessary for the pregnancy to be terminated, the attending physicians performed a curettage under gas-oxygen anesthesia, and removed a fetus estimated to be of ten weeks' development. She had a steady convalescence after one week of serious illness and was up and about in three weeks.

In a series of cases of angiosclerosis, we obtained positive reactions with artery and in several instances with adrenal substrate.

In the experimental tests on dogs we believe that our evidence in the foregoing cases substantiates the results of other writers who hold that the protective ferments show specificity in the Abderhalden dialysis reaction.

In a series of thyroid transplants we have been able in 17 instances out of 23 to show positive reactions with suprarenal and in 2 instances a positive reaction also with pancreas, but only 1 positive reaction with spleen. All of our specimens of blood taken from animals following the transplantation of organs with

ABDERHALDEN REACTION FOLLOWING TRANSPLANTATION OF ORGANS

Dog Number	Coar. Lact. Test	Time of Days & Hours	Serum Control	Serum + Adrenal	Serum + Spleen	Serum + Pancreas	Serum + Kidney Gland	Serum + Thyroid
114	1.0	10	0	+++	+			
150	1.5	24	0	+	0			
180	1.0	24	0	+	0			
101	1.0	24	0	+	0			
114	1.0	24	0	+		++		
282	1.0	24	0	+		+		
282	1.0	24	0	+				
282	1.0	24	0	+				
214	1.0	24	0	++				
282	1.0	24	0		0			
214	1.0	24	0				+	
100	1.0	24	0	0				
114	1.0	24	0			+		
214	1.0	24	0	+				+
208	1.0	24	0	0		+		
141	1.0	20	0	++	+			
114	1.5	24	0	+				
114	1.5	24	0	++				
114	1.5	24	0	0				
132	1.5	24	0	++				
164	1.5	24	0	+				
101	1.5	24	0	++				
212	1.5	24	0	+				

the use of blood-vessel suture reacted positive with the substrate artery

We conclude that the test is of great value in confirming clinical observations, and that those who rely upon laboratory tests alone for diagnosis are bound to be disappointed, not on account of the inferiority of the test but of its necessary limitations

To those who kindly contributed specimens we desire to express our thanks

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FURTHER STUDY OF IRREGULAR KIDNEY VESSELS AS FOUND IN ONE HUNDRED EIGHTEEN CADAVERS

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VARIATIONS in the renal arteries and veins have been the subject of repeated study, and a voluminous literature exists. The subject, however, is well worthy of further study, not only from the morphological, but more especially from the surgical, standpoint.

The present study was begun in 1912 and the data accumulated during one year was published in 1913. The additional data which has been gathered since that time is presented in the following pages.

The specimens on which this paper is based were removed from dissecting-room material. The blood vessels and ureters were sketched *in situ*. Then the kidneys were removed with the aorta, vena cava, and ureters attached. By this method the observations made on the structures *in situ* were confirmed and elaborated. Altogether the kidneys from 118 cadavers were studied, 13 were males and 15 were females. The males included 98 whites and 5 negroes, the females included 13 whites and 2 negroes. Of the cadavers showing variations in the renal vessels, there were 57 males and 15 females, the males included 56 whites and 1 negro, the females 13 whites and 2 negroes. In the 118 cadavers there were 72, or 61 per cent, which showed either a unilateral or bilateral variation of artery or vein, or of both.

The great majority of texts lay little emphasis upon variations in blood-vessels. There are, however, a number of special articles scattered through the literature which deal more or less exhaustively with these variations.

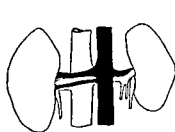
I am especially indebted to Dr Charles Davison and Dr T. A. Davis for many helpful suggestions in the work, and to Dr A. C. Cycleshimer for his help in the preparation of the article.

No attempt has been made to gather all

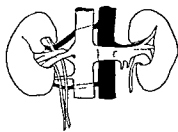
the literature on the subject. The list of papers and abstracts available date from 1857 with the publication of the first volume of Henle's *Berichte über die Fortschritte der Anatomie*.

Long before this time many observations had been made. Du Breuil in 1847, in his *Anomalies arterielles*, recorded many variations. Hyrtl, Kunst, and others recorded such rare variations as the hepatic arising from the renal. Blancherd in 1869 presented a case with four renal arteries. Portal reported a case in which there was a single trunk arising from the aorta which bifurcated into a right and left renal. Merkel, Otto, and others observed cases in which there were five arteries on one side. Otto describes a case in which a branch from the common iliac supplied the kidney. These and other scattered observations led to more extended studies.

Macallister records numerous conditions under (1) variations in origin, (2) variations in branching, (3) variations in point of entrance, (4) distribution of branches. He finds that the kidney may be supplied by (a) *arteria suprarenalis*, (b) *arteria lumbalis* II, III, (c) *hepatica dextra*, (d) *colica dextra*, (e) *iliaca externa*, (f) *iliaca interna*, (g) *iliaca media*, (h) *sacralis media*. Under variations in branching he finds three or four to be the commonest number which enter the substance of the kidney. As high as ten have been observed. As to point of entrance, all enter the hilum. Under distribution of branches it was found that the renal usually sends branches to the suprarenal, sometimes to the diaphragm, right colon, pancreas, testis, and liver. Schmerber in 1895 found that in 100 subjects there were double renal arteries in 14 cases, and these were bilateral; but when found on one side only they were usually on the left side. He also records the renal as often arising from the spermatic



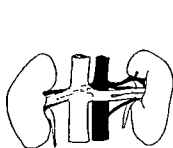
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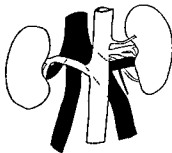
Anterior View, No. 4



Anterior View, No. 7



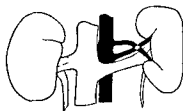
Anterior View, No. 12



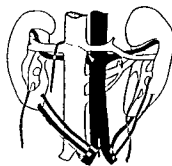
Anterior View, No. 28, Table 45



Anterior View, No. 30, Table 43



Anterior View, No. 35, Table 4



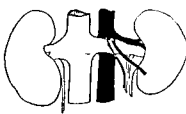
Anterior View, No. 43, Table 8



Anterior View, No. 45, Table 4



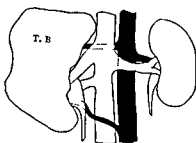
Anterior View, No. 47, Table 6



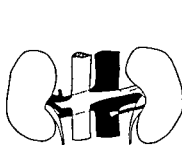
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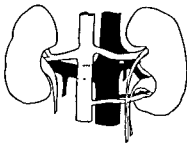
Anterior View, No. 50, Table 12



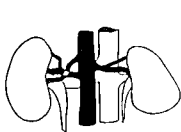
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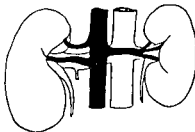
Posterior View, No 1, also 3, 10, 11, 62



Posterior View, No 4.



Posterior View, No 5



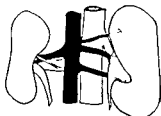
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Posterior View, No 8



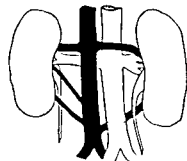
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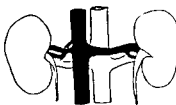
Posterior View, No 13



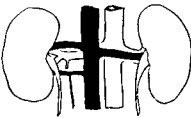
Posterior View, No 14



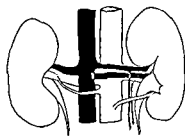
Posterior View, No 16, Table 16



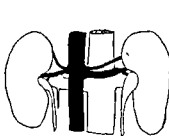
Posterior View No 15, Table 15



Posterior View, No 17, Table 17.



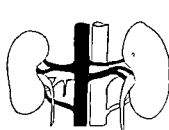
Posterior View, No 18, Table 20



Posterior View, No 19, Table 21



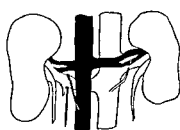
Posterior View, No 20, Table 22.



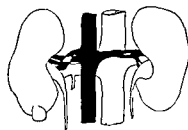
Posterior View, No 21, Table 24



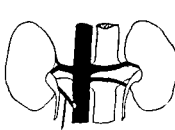
Posterior View, No. 22, Table 25



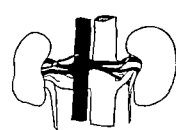
Posterior View, No 23, Table 27



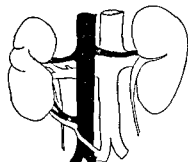
Posterior View, No 24, Table 28



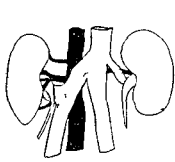
Posterior View, No 25, Table 30



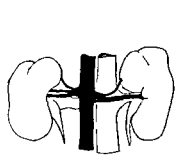
Posterior View, No 26, Table 31



Posterior View, No 27, Table 32



Posterior View No 28, Table 43



Posterior View, No 29, Table 40

The modern textbooks give practically the same description of the renal arteries as Macallister, while Corning, in addition to the text, gives some very fine plates of the more extreme types in variations, such as are represented by Nos 16 and 43 of this series.

It has been said that "most commonly anomalous vessels are found at the upper extremity of the kidney." The following table shows the contrast between superior and inferior polar arteries of this series:

Superior pole only, 20 cadavers (16+per cent); 20 kidneys 12 right, 8 left (Nos 57, 64, 44, 32, 12, 7, 13, 42, 69, 20, 61, 45, 58, 36, 26, 48, 3, 68 inches, 37 inches, 34 inches)

Inferior pole only, 11 cadavers (9+per cent), 10 kidneys: 3 right, 7 left (Nos 49, 50, 18, 21, 4, 27, 60, 33, 30, 18, 7, 43 68, inches, 37 inches, 34 inches)

Nos 21, 4, 27, 30, 18, 7, and 43 show anomalous polar veins 8 right and 2 left.

Superior and inferior pole, same side, 5 cadavers (4+per cent) 5 kidneys: 2 right, 3 left (Nos 66, 46, 21, 52, 28)

Superior poles, both sides, 5 cadavers (4+per cent) 10 kidneys (Nos 6, 5, 9, 19, 29).

Inferior poles, both sides, 3 cadavers (2+per cent) 6 kidneys (Nos 30, 16, 43).

Superior and inferior poles, both sides, none.

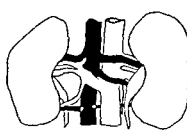
The renal veins in this series did not "share the frequency of anomalous distribution with the arteries"

In 63 cadavers (53+per cent), 77 kidneys showed variations in the arteries 21 right, 28 left, 14 both sides

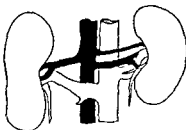
In 31 cadavers (27+per cent), 26 kidneys showed variations in veins 30 right, 1 left, 3 both

In my previous article all cadavers showing variations of the veins, on one side only, had this variation on the right side. With one exception this is true in this series. Eight cadavers showed anomalies of the veins only, and these anomalies were all on the right side. The axis type of bifid arteries corresponds to the "precocious division" of Gerard

No	Arteries		Veins		Axis		Two Artery Type
	Left	Right	Left	Right	Left	Right	
3		2					
4		2		3			Ureter, double 5 inches long to point cut
5	2					2	
6	2						
7	2			2			
9	2						
15	2						
17	2						
18		2	2	2			Right spermatic artery originates from right suprarenal artery. Right spermatic vein empties into renal vein. Left renal vein divides and empties into vena cava at two points.
21	2	2		2			
22		2		2			Right spermatic artery originates from inferior renal artery size knitting needle enters superior pole left kidney from suprarenal artery.
23	2	2					Left spermatic artery from inferior renal artery.
27	2		2				Inferior vein on left extends from inferior pole of kidney to left common iliac vein.
31		2		2			Left renal vein posterior to aorta.
32		2					
34	2	2		2			
35	2						
39	2	2		2			Branch left renal vein winds around artery before joining vena cava.
41		2					
44	2						
57		2		2			Superior renal artery gives off three branches from an axis right veins form an axis.
61		2		2			Variation in entrance of left renal vein into vena cava.
67	2						
68	2			2			
64	2	2					
59	2	2	2				Left renal vein divides to enter vena cava at two different points.
55	2						
53	2						
52		2		2			Inferior renal artery anterior to vena cava. Superior renal artery posterior to vena cava.
51		2		2			
50	2						
49	2						
47	2						
45		2		2			Inferior renal artery anterior to vena cava.
43		2					Left renal vein divides to enter vena cava at two separate points.
42							
33	20	5	25	0	2		



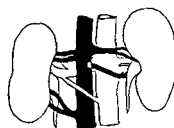
Posterior View, No. 30, Table 43



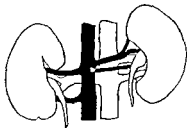
Posterior View, No. 31, Table 44



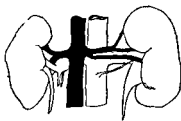
Posterior View, No. 32, Table 6



Posterior View, No. 33, Table 7



Posterior View, No. 34, Table 5



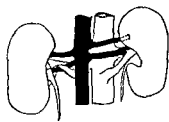
Posterior View, No. 36, Table 1



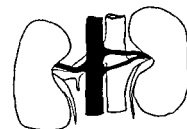
Posterior View, No. 37, Table 9



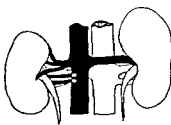
Posterior View, No. 39, Table 13



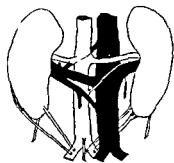
Posterior View, No. 40, Table 11



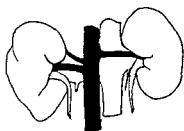
Posterior View, No. 41, Table 37



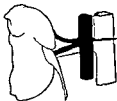
Posterior View, No. 42, Table 12



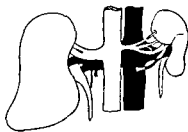
Posterior View, No. 43, Table 8



Posterior View, No 44, Table 33



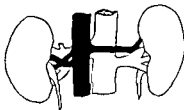
Posterior View, No 45



Posterior View, No. 48, Table 7



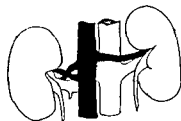
Posterior View, No 51, Table 15



Posterior View, No 53, Table 17



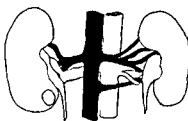
Posterior View, No 54, Table 18



Posterior View, No 55, Table 19



Posterior View, No 56, Table 20



Posterior View, No 57, Table 24



Posterior View, Nos 58 and 70, Table 25



Posterior View No 59 Table 27



Posterior View, No 60



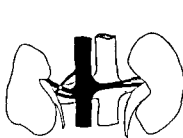
Posterior View No 61 also 38



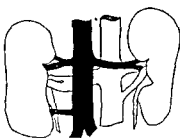
Posterior View No 63, Table 32



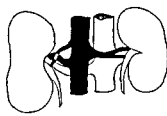
Posterior View, No. 64, Table 33



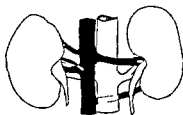
Posterior View, No 65, Table 42



Posterior View, No 66, Table 39



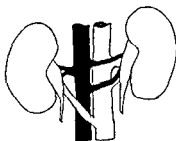
Posterior View, No 67, Table 37



Posterior View, No 68, Table 35



Posterior View, No 69, Table 38



Posterior View, No 71, Table 43

ARTERIES

Left side only	21
Right side only	8
Both sides	8

VEINS

Left side only	6
Right side only	30
Both sides	0

VEINS AND ARTERIES IN SAME CADAVER

Left side	2
Right side	12
Both sides	2

VEINS ONLY

Left side	0
Right side	0
Both sides	0

Attention is called to three specimens (Nos. 68, 37, 34), which are rather difficult to classify. They are listed under "superior polar type" and "inferior polar type" on that account.

Two specimens show that one of the irregular arteries makes one complete twist around one of the branches of the renal vein or vice versa.

Seven specimens, a rather large percentage, it seems to me, show relatively the same pecu-

liar arrangement of the renal vein, or veins, as shown by Specimen No. 63. Eleven specimens, including the seven above, show variation in arteries or veins passing anterior to, or posterior to, the vena cava or aorta, when their normal position should have been the opposite of the one occupied—Nos 46, 63, 18, 27, 52, 59, 16, 68, 30, 60, 43.

The cadavers from which these specimens were obtained were used in two lots; i.e., first and second semester, and the tables when placed in position in the anatomical laboratory were arranged in groups of 20 and numbered consecutively, beginning at No 1.

It is of interest to note the sequence of numbers of the tables holding a cadaver whose kidney or kidneys show variations in renal blood-vessels. The first group of 20 cadavers—40 kidneys—gave 11 variations. Every cadaver on the last 6 tables, Nos 15 to 20 inclusive, showed a kidney or kidneys having an irregular blood-vessel.

The second group of 20 cadavers—40 kidneys—showed 12 variations in blood-vessels. The third group of 20 cadavers—40 kidneys—showed 17 variations, every

No	Arteries		Veins		Axis		Three Artery Type
	Left	Right	Left	Right	Left	Right	
12	3	2					Two arteries from an axis superior
13		3					
16	3	2					Inferior arteries on both sides originate near bifurcation of aorta. On left inferior artery is anterior to vena cava. On right superior artery posterior to vena cava.
25	3						Common iliacs join opposite ilium of kidneys to form vena cava
30	2	3		3			Two superior arteries on right pass posterior to vena cava. Inferior artery passes anterior to vena cava.
33	3	2	2	2			Left renal vein branches into two divisions
37	3						Upper two arteries form an axis
42	3			2			Superior artery gives off three branches from an axis
43	3	3	3	2			Two left inferior arteries branches of left common iliac. On right one artery from right common iliac and one from median sacral
60		3					
63	3	2					Right superior artery posterior to vena cava. Right inferior artery anterior to vena cava.
65	3						Two inferior arteries from an axis
66		3		2			Two superior arteries from an axis. Left renal vein divides to enter vena cava at two points
76		3	2		3		Left inferior arteries from an axis
	10	10	3	5	2	0	

No	Arteries		Veins		Axis		(Artery) Type
	Left	Right	Left	Right	Left	Right	
19	2	2					
20	2						Left renal vein posterior to aorta
23	2			2			Left spermatic vein passes up and over left renal vein
24	2						
29	3	2					
36		2		2			
38	2						
45	2						Right renal artery small cordlike structure congenital absence of right kidney uterus Unicornate
70	2	2					
61		2					
53		3					
56	2						
	0	6	0	2			

Number	Left	Right	Veins Only
1		2	Accessory vein small
3		2	Accessory vein small
8		2	Accessory vein small
10		2	Accessory vein small
11		2	Accessory vein small
62		2	
43		2	Right artery an axis giving off three branches. Right kidney congenitally small
54		2	
	0	3	

cadaver on tables 50 to 59 inclusive showing a variation in blood-vessels. The fourth group of 20 cadavers — 40 kidneys — showed 13 variations, every cadaver on tables 73 to 78 inclusive showing variations in blood-vessels. The fifth group of 20 cadavers — 40 kidneys — showed 10 variations, the sixth group of 18 cadavers — 36 kidneys — 9 variations, cadavers on tables 104 to 108 inclusive showing variations in blood-vessels.

Those cadavers showing a variation in the renal blood-vessels are marked with a plus sign, those not showing any variation are designated by a minus sign.

In this series of 118 cadavers there were no movable, pelvic, or horseshoe kidneys found. There was one, No 48, right, kidney congenitally small, being 6.5 x 3.5 x 2 cm in its greatest measurement, this variation, according to Treves, occurring once in four thousand cases.

One cadaver, No 45, showed the congenital absence of one kidney, which variation Treves also mentions as occurring once in four thousand cases. The opposite kidney in this specimen has two arteries. This cadaver also had a unicornate uterus, the opposite horn of the uterus being missing.

TREATMENT OF HAND INFECTIONS FROM AN ECONOMIC VIEWPOINT

BASED ON A STUDY OF 1600 CASES¹

BY HARRY E. MOCK, M.D., CHICAGO

THE physician, if endowed with enthusiasm for his work, is constantly striving to the best of his ability to prevent disease and injury, to restore health in the shortest time possible, and to reduce the death-rate to a minimum: therefore, he is an economist of great value to the community.

Those of us engaged in emergency accident work for any industry are naturally trained, by the very nature of the work, to view every case from its economic standpoint. An accident occurs, and at once we plan the subsequent handling of the case with these four fundamental principles in mind:

1. How to prevent recurrence of accident.
2. How to aid recovery the quickest.
3. How to prevent permanent disability.
4. How to avoid fatal termination of case.

There is no selfish reason involved, but the welfare of the patient, the protection of the other employees, and the interests of the employer, all demand the careful consideration of these principles, purely and only, from an economic basis.

Certain complications following injuries must likewise be studied along these same lines, and chief among these is *infection*. Infections, as a rule, follow minor accidents, and minor accidents are by far the hardest type to prevent. Infections following minor injuries to fingers and hands are so common that these have been chosen to illustrate the great value of following the above economic principles in the treatment of these cases.

The part played by hand infections in the economy of the industrial world is shown by the following statistics and statements from various industries and accident insurance companies:

1. From 4971 accidents, 11 per cent became infected. Total disability from these accidents was 13,000 days, and 20 per cent of this was due to the infections.
2. From one of the stock-yard plants:

75 per cent of disability from hand injuries is the result of infections, 25 per cent of disability from hand infections is due to other causes, such as broken bones, etc.; 90 per cent of these hand infections report late, after the infection has developed, 75 per cent of their hand deformities are the result of infections.

3. Figures obtained from the claim departments of five of our largest accident insurance companies:

a. 15 per cent of the total disability is due to hand injuries. In 20 per cent of these hand injuries, the disability is due to infections.

b. 7 per cent to 9 per cent of the total disability from all accidents is due to hand infections.

c. From 1,000 consecutive cases, 5.7 per cent of the total disability was due to hand infections.

d. From 10 to 20 per cent of the total disability is due to hand infections. It depends on the type of work done by insured. When engaged in heavy work, where the injuries are usually serious, the infections are less, but if engaged in light work, where minor accidents are the rule, the infections are greatly increased.

e. Of all hand accidents, it is estimated that 65 per cent requiring disability are the result of minor injuries which have become infected, 35 per cent requiring disability are due to other injuries, as broken fingers, lacerations, crushing injuries, etc.

In talking with a number of company surgeons and managers of claim departments, I find that no definite statistics are available on this subject. They all agree, however, that—

1. Hand infections cause a high percentage of their disability.
2. Over 50 per cent of their hand deformities are the result of infected injuries.

¹ Read before the Kankakee (Ill.) County Medical Society, February 1915 and the Illinois Manufacturers' Association, March, 1915.

3 A great many amputations result from neglected, infected fingers

4 Hand infections are usually the result of minor injuries, such as pin pricks, nail wounds, splinters, scratches, small cuts, cracked hands, blisters, contusions, and abrasions. Such minor cases, as a rule, do not report to the doctor until the infection has developed

5 Severe hand injuries, such as extensive lacerations, or severe crushing injuries, seldom become infected. The nature of these injuries is such that the patients are forced to consult a doctor at once

6 That early treatment of all accidents, no matter how slight, would reduce infections to a marked degree

PREVENTION

Prevention of infections is one of the most fertile fields of endeavor open to the company surgeon. It is the "Safety First" movement for the injured. A careful study of the etiology of every infection will show that the majority are due to preventable minor accidents, and by a removal of these causes a great reduction in infections will ensue. As an example, the lining of bins which had become loosened was the frequent cause of injuries which became infected. In every case, a notice was sent to the manager, pointing out the preventable nature of this accident, and in one year the injuries from this source were reduced from 75 to 10. The same procedure was followed in the case of broken baskets, exposed ends of wire, nails on the floor, pins in packages, etc., all resulting in a decrease in minor accidents and therefore in infections.

Tincture of iodine is the greatest protection against infection that can be used. Every industry should supply each department with a bottle of tincture of iodine and another bottle containing applicators, and should instruct each employee to paint every wound, no matter how slight, with the tincture of iodine *at once*, even before reporting to the doctor. The importance of its use should be pointed out to the department foremen again and again, in order that they may instruct each new employee as to its value. In 1909, impressed by the great

number of hand infections reporting to the doctor's office in a large industry, I installed this use of iodine as a preventive measure. Immediately, there was a reduction of 38 per cent in the number of infections. Practically all of the infected cases failed to use iodine at once. The following figures taken from last year's report show the importance both of using iodine and of reporting to the doctor at once for dressing:

From 3,000 accidents, 44 per cent reported at once, and 41 per cent used iodine at once, 43 per cent reported late and failed to use iodine; the remainder were cases where its use was not indicated

From the above number there were 654 infections. 12 of these used iodine and reported at once, 24 failed to use iodine, but reported at once, 618 reported from one day to one month after receiving the injury with the part infected — average time was from one to three days afterward, of this number, 40 per cent used iodine somewhat later, while 60 per cent failed to use it at all

The 36 infections that used iodine or reported immediately were all very slight and did not require opening, while 440 of the group who failed to use it or reported late required incisions, thus necessitating 1912 days of disability and further decreased efficiency by working with a finger or hand bandaged for several days. A large percentage of these cases occurred among new employees

The importance of early reporting to the doctor for a dressing is not only demonstrated by the above figures, but by the fact that major injuries, which force the employee to report at once, seldom become infected

The use of hydrogen peroxide, bichloride wash, or soap and water on a fresh wound is never indicated. These methods tend to scatter the dirt and infection throughout the wound. Hydrogen peroxide especially, by its foaming, expansive power, carries dirt deeper into the wound without killing the germs of infection. Even in the use of iodine, the effort is not so much to cleanse the wound, as to inhibit the growth of any germs that might have been introduced

Another form of prevention is the removal

of all predisposing causes for infection in the employees themselves. The generally run-down, anæmic, undernourished individual, or those suffering from chronic diseases, are more prone to injuries and injury infections. Thus, the discovery of the diseased employee by a periodical medical examination of all employees is a valuable adjunct to any system of prevention. By proper advice many of these diseased conditions can be overcome, a change of work may be indicated in other cases, and the regulation of the employee's mode of living, both at work and at home, and as regards outdoor exercise, will correct a great many of the anæmic, undernourished, and run down conditions. In girls, we frequently see recurring infections in the same individuals. A study of the case will reveal a marked anæmia, the correction of which overcomes her tendency to infections.

Tonsillitis, one of the chief causes of sick disability among employees, also plays a marked rôle in the cause of infections. In the winter months, when tonsillitis is the most prevalent, our infections are correspondingly high. The coincidence of tonsillitis and finger and hand infections was noted so often that I made a careful bacteriological study of a series of these cases, and, as a rule, the same germ was found as the cause of both.

The following table shows this relationship. Note the increase in hand infections with the increase in tonsillitis. (These figures are taken from the same working force with the same working conditions prevailing.)

January and February, 1913	Total number cases of tonsillitis	327
January and February, 1913	Total number cases of hand infections	83
	Total days disability from hand infections	63
	Number of hand infections having tonsillitis at time or just before infection developed	15 or 18 per cent

In 1914 we had in Chicago a serious epidemic of tonsillitis of the streptococcic type.

January and February, 1914	Total number cases of tonsillitis	603
January and February, 1914	Total number cases of hand infections	117
	Total days of disability from hand infections	208
	Number of hand infections having tonsillitis at time or just before infection developed	32, or 27.9 per cent



Fig. 1. Lymphangitis of the arm from an infection on back of hand. Thirty-six hours in the hospital with continuous hot dressings relieved this condition without surgical interference.

The greatly increased disability in 1914 was due to 24 very serious cases with marked lymphangitis and tenosynovitis, all of whom had tonsillitis. Twelve of these were due to a hemolytic streptococcus, and the same organism was found in the patient's tonsils. Twelve others had a marked lymphangitis, and while the organism was not ascertained, yet these were undoubtedly streptococcus infections and closely related to the tonsillitis.

The removal of the tonsils when diseased therefore, would not only stop the sick disability and the spread of the disease throughout a department as an epidemic, but would be a great preventive measure against infections.

A further and very important factor in the prevention of infections is a suitable emergency office, where the most aseptic surgical treatment can be rendered.

Thus the most valuable preventive measures in the economic care of infections are —

- 1 The use of tincture of iodine at once as a prophylactic measure
- 2 The sending of every injured employee to the doctor for immediate dressing
- 3 Removal of external causes for accidents — found in the working place
- 4 Removal of predisposing causes for infections — found in the employees

The following table shows the percentage of all infections as compared with the total number of accidents each year, for the last three years.

Year	Number of Accidents	Number of Infections
1912	2603	772 or 29.6 per cent
1913	4383	320 or 7.5 per cent
1914	4971	654 or 11.0 per cent



Fig 2 Thenar space abscess from a neglected knife-wound of the thumb. Through and through drainage under a general anæsthetic and hospital treatment for three days gave a prompt recovery

The fact that the total number of infections has decreased so markedly in the last two years, notwithstanding a 40 per cent increase in the number of accident cases reporting to the doctor's office, is due chiefly to the enforcement of the rules that every accident case must report at once to the doctor, and, when indicated, must use iodine at once.

ACTIVE TREATMENT

When an infection has once developed the best medical treatment is at times the most expensive, but in the long run, it is the most economical. Too often, a doctor hopes to save his patient loss of time or if he is a company surgeon he hopes to treat the case and still keep him at work, thus he adopts what at first seems the most economic line of treatment but by so doing frequently temporizes with the infection. The death rate from hand infections among the medical profession is notoriously high. I believe this is due not so much to the peculiar nature of the doctor's work, wherein he is brought into close contact with diseased conditions, as

to the fact that most doctors temporize with an infection which they have contracted, rather than adopt active treatment at once.

From a careful study of 1,600 cases of finger and hand infections and their complications during the last three years, I am convinced that a radical form of treatment of all hand infections is the most economical plan that can be adopted.

The initial cost of such treatment will exceed a temporizing effort, such as opening an infection in the office and allowing the patient to go about his duties, but the length of treatment and the complications developing from the latter method will far exceed that which follows the treatment of all infections as serious from their inception. In dealing with this subject from an economic viewpoint, it is not the actual cost of medical services which is referred to, but the actual economy to the patient and to the concern for which he works. The most perfect line of treatment must give—

- 1 The shortest disability, with a minimum amount of suffering, and the fewest hardships to those dependent upon the patient,

- 2 It must prevent permanent deformities, such as loss of function, or loss of fingers,

- 3 It must reduce the death-rate to a minimum.

These 1,600 cases of hand infections were chiefly the result of minor accidents, such as the following, named in their order of frequency: pin pricks, splinters, abrasions from baskets, boxes, bins, etc., lacerations from knives, scissors, and other sharp utensils, bruises and contusions, nail wounds, scratches from tin and wire. The greater portion of these infections were very slight, causing no loss of time from work, and requiring from 3 to 10 dressings. Nevertheless, there was a certain disability connected with them, as an employee with a bandaged finger or hand has less working capacity than an unhampered employee. Therefore reduction in the total number of infections means a marked saving in this form of disability. It has been further reduced by careful attention to the simplest yet adequate dressing which can be applied. A certain number of the



Fig 3 Tenosynovitis of middle finger with middle palmar abscess—result of cutting finger on steel tag. Was given ambulatory treatment, with an effort to drain abscess through small incision on flexor surface of finger. Proper early drainage of the synovial sheath of the middle finger would have prevented this condition.

above infections became serious requiring considerable treatment either at home or at the hospital, and caused an actual loss of time from work. Thus, the 1,600 cases may be classified as follows:

- a Mild, or causing no loss of time, 1,189, or 74 per cent
- b Serious, or causing loss of time 411 or 26 per cent

In order to arrive at the best and most economic treatment of these hand infections, it is necessary for us to study the 411 cases from the above table which were serious enough to require actual disability.

One of two plans of treatment was adopted in every case of hand infection, namely, ambulatory treatment, or hospital treatment. The ambulatory care consisted in opening the infected part at the doctor's office and allowing the patient to go home, reporting to the office for subsequent dressings. Frequently these infections were incised by the use of a local anæsthetic, but a general anæsthetic was never administered in the doctor's office. When necessary, instructions



Fig 4 Deformity of hand—result of generalized cellulitis of forearm and involvement of radial and ulnar bursae. Initial injury. Slight contusion at base of palm. Early hospital treatment and proper diagnosis of the location of pus would have prevented this deformity.

were given to the patient as to the use of hot dressings at home, and a nurse would call to see that these instructions were carried out. Naturally these infections were not as serious as those given hospital treatment, but in spite of this fact their average disability was greater. The absolute rest obtained by hospital treatment would cause more rapid recovery of these cases, but the idea of going to a hospital for a small, minor infection does not appeal to most patients.

When a hand infection showed signs of becoming at all serious, or threatened complications were apparent, we insisted upon hospital treatment. Here the infection could be opened under a general anæsthetic of nitrous oxide gas, and the patient kept absolutely quiet in bed with continuous hot, moist dressings applied until the acuteness of the condition had subsided. Likewise, many cases of threatened serious infection could be aborted and the necessity of opening these overcome by sending the patient to the hospital, giving him absolute rest in bed, preventing the movement of the infected part, and applying continuous hot packs for 24 or 48 hours.

The use of a general gas anæsthetic is one of the most valuable features of this hospital treatment when it is necessary to operate on these hands. The work of the operator is much more thorough, and incisions into the infected part are larger and better drainage is established. Wide open, radical treatment of these infections means a much more rapid



Fig 5. Deformed hand—result of splinter wound at base of thumb. This deformity resulted from trying office treatment and from a wrong diagnosis of the location of the pus. The middle palmar space was opened, when the thenar space was involved. As a result, the middle palmar space and ulnar bursa both became infected. No pus was found on opening middle palmar space. Twenty-four hours later patient entered hospital and through and through drainage of thenar space revealed location of pus.

recovery, therefore the advantage of this procedure. The history of the treatment of hand infections is one of following the pus by making additional incisions. I frequently an infected hand is operated upon two, three or even more times, whereas, if sufficient drainage is established at the first incision, subsequent openings are not necessary. Ninety-five per cent of the infected hands requiring two or more operations occur in those cases given office treatment.

Besides reducing disability a number of these serious hand infections would have resulted in permanent deformities if this radical form of treatment had not been adopted early. The accompanying table demonstrates the great advantages of hospital treatment for hand infections as compared to ambulatory treatment.

From a study of the above facts I am positive that *dangerous infections can be prevented and disability reduced by the early adoption of hospital treatment.* The reasons therefore are—

First, the patient can be kept absolutely quiet and under better control than at home. This is very essential as most of these infections are accompanied by a low-grade fever.

Second, continuous hot dressings can be better applied by a trained nurse than by the relatives.

AMBULATORY VERSUS HOSPITAL TREATMENT OF SERIOUS HAND INFECTIONS

	Treated at doctor's Office and at Home	Treated at Hospital
Total number	253	246
Opened	210 =	78
Not opened	43 or 17%	68 or 28%
Total loss of time from work	2700 days	1088 days
Average loss of time per case	11.03 days	7.4 days
Permanent disability as loss of function of member	0	21
Deaths	0	0

¹ 25 per cent loss of function by stiff middle finger
 10 per cent loss of function by stiff thumb

Third, better operations can be performed because of the general gas anæsthetic, thus reducing the length of treatment, and necessitating fewer second operations.

There are 12 very serious, complicated cases of hand infections from this series which are not included in the above table, as these were first given home treatment, usually by their family physician, and later, as a final resort, came under our care at the hospital. The serious results of this delayed treatment are conclusively demonstrated by the following chart.

SERIOUS, COMPLICATED CASES TREATED AT HOME AND TAKEN TO HOSPITAL AS FINAL RESORT

Total number	12
Opened	12
Total loss of time from work	170 days
Average loss of time per case	14.15 days
Permanent disability loss of function or member	5 ¹
Deaths	0

¹ First joint index finger right hand stiff one case.
 First and the 1st fingers of right hand are flexed and stiff one case.
 Four fingers of right hand slightly flexed and stiff one case.
 Index finger left hand amputated one case.
 Index finger right hand amputated one case.

A short résumé of two of these cases is typical of the entire series of twelve hand infections.

Miss K, 17 years old, pricked the middle finger of her right hand with a pin on January 5, 1914. This was two days after her employment. One of the witnesses suggested the use of iodine, but the patient did not think this necessary. January 10, five days later she reported to the doctor's office with marked lymphangitis of the arm and considerable induration about the axilla which extended on to the chest wall both subcutaneously and back to the border of the scapula. Swelling was quite firm and tender but no inflammatory reaction of the skin was present. Temperature was 102°, pulse

roo Had a slight tonsillitis and pharyngitis, but otherwise the general examination was negative. There was no localized infection about the point of injury. The patient was sent to the hospital and under a general anæsthetic the axillary and the shoulder abscesses were incised at three different points, and tube and gutter percha drainage inserted. At least 8 ounces of thin, yellowish pus was evacuated. Large hot boric acid dressings were applied to the site of operation and a second large hot dressing applied from the fingers to the axilla over the site of the lymphangitis. Subsequent course. In spite of the evacuation of the pus, the temperature continued to rise. The second day the temperature was 103° , pulse 120, third day, $103\frac{1}{2}^{\circ}$, pulse 120, fourth day, 105° , pulse 140. The patient was exceedingly sick and showed all the signs of a general systemic infection. The fifth day temperature was 104° , pulse 120, the sixth day, temperature 100° to 102° , and from this time on it gradually subsided, until at the end of two weeks it reached normal and remained there. On the third day, a stock streptococcus vaccine was injected, and on the fourth day, a small dose (50 million) of autogenous vaccine, which had been prepared, was injected. A slightly larger dose of autogenous vaccine was given on the sixth day, and again on the ninth day. These vaccines were repeated every four days for four more doses. She left the hospital at the end of 3½ weeks, and recovery was complete at the end of five weeks. The neglect of this minor injury and the late reporting after the trouble had started were the chief reasons for this girl's serious sickness.

Mr E., an old employee, received a slight contusion of the hand on March 4, 1912. The cause of the accident was unknown. He had been under the care of his family physician because he did not think his work was responsible for the injury. The hand at first became swollen, then the forearm which was badly inflamed and very tender. This swelling increased until his family physician was called on the fourth day. Three small incisions were made on the flexor surface of the forearm and were extended through the skin to the fascia. A little serous exudate was found but no pus. These incisions became infected, and superficial abscesses developed on the forearm during the next ten days, which were opened and drained by small incisions. The swelling in the arm increased to an immense size and the entire forearm assumed a dark red, brawny appearance. The patient came under my care March 18 and was taken to the hospital. A diagnosis of diffuse cellulitis of the forearm was made, with large collections of pus in both the ulnar and radial bursæ and the intramuscular spaces. Under a general anæsthetic large incisions were made at each side of the forearm just above the wrist joint, and the ulnar and radial bursæ drained by through-and-through drainage. A large incision was then made through the upper two thirds of the forearm slightly to the ulnar side of the middle of

the flexor surface. From this incision, all intramuscular abscesses were opened and drained. Infection was found to be a staphylococcus pyogenes aureus, and autogenous vaccines were made and used for several weeks. This man ran a temperature from 99° to 102° , with a weak, thready pulse of 110 to 130 for at least six weeks. His was the typical picture of sepsis. Acute nephritis developed, but gradually disappeared with recovery from his infection. For several days we despaired of this man's life. Recovery was practically complete about the middle of June, some three months later. Permanent deformities remain in this case. His four fingers are flexed about 25 per cent, and can not be completely extended nor closed.

This man's long disability, loss of function in the fingers, and the narrow escape from death were all the result of neglecting a simple injury, trying ambulatory treatment when hospital treatment should have been instituted together, with inadequate drainage during the early course of the disease (Fig. 5).

The remainder of the cases in this group all neglected prophylactic measures at the time of the minor injury, a few were given first aid by fellow employees, as attempted removal of a splinter from the hand, in which case a portion of it was left in, all reported to the doctor from three days to one month after receiving their injuries, and seven were given office treatment by their family physicians for a few days before being sent to the hospital. The five cases of permanent deformities, two with loss of fingers are the direct result of the above negligence.

ECONOMIC VALUE OF PROPER DIAGNOSIS OF LOCATION OF PUS AND PROPER SURGICAL INTERFERENCE IN HAND INFECTIONS

Many cases of prolonged disability and also of permanent deformities result from a wrong diagnosis of the type of infection and a lack of understanding as to the location of the pus, and inadequate surgical interference — either too small incisions or at times too large or too many incisions. Some of our cases of serious deformities come under this heading. Kanavel has demonstrated conclusively that there are certain definite spaces where infection entering at various points on the hand tends to spread. The most important of these spaces are —

- 1 The synovial sheaths about the tendons — the commonest site for the more serious forms of hand infections

2 The lumbrical and subaponeurotic space at the edge of the palm, where the so called "collar-button" abscesses form

3 The thenar space

4 The middle palmar space

5 The hypothenar space

6 The radial bursa

7 The ulnar bursa

Through the last two spaces infections usually spread from the hand to the forearm.

A knowledge of these spaces and the location of injuries that usually lead to their involvement should be had to open properly and drain these most serious types of hand infections. To know the relations and boundaries of these various spaces is just as important as it is to know where to enter the abdomen for the appendix or to reach the gall bladder. In other words infections about the fingers and hand have too long been considered of rather minor importance and have been treated accordingly whereas they must be recognized as very grave serious conditions and must be studied and treated by the most approved surgical procedures, and every possible adjunct both locally and constitutionally must be employed to hasten recovery and prevent a spread of the infection.

A classification of the various types, as to location of the 411 cases of hand infections which were serious enough to cause disability will give the relative frequency of the involvement of these different spaces.

I The types of hand infections named in their order of frequency which were given ambulatory treatment

a Paronychia	90
b Superficial or subepithelial abscesses	7
c Abscesses in superficial connective-tissue spaces—cellulitis of hand	45
d Carbuncular infections	70
e Lymphangitis of arm from hand injury	11
f Felons	10
g Collar button abscesses (distal edge of palm)	3
Total	253

II The types of hand infections named in their order of frequency, which were given hospital treatment

a Lymphangitis of arm from hand injuries	50
b Felons	24
c Tenosynovitis	24
d Abscesses in superficial connective tissue spaces—cellulitis of hand	14
e Collar button abscesses	7
f Carbuncular infections	5
g Middle palmar space infections	5
h Paronychia	3
i Thenar space infections	3
j Hypothenar space infections	2
Total	146

III The twelve very serious cases where active treatment was adopted late were characterized by having more than one space involved, or some other form of complication, as follows

a Diffuse cellulitis of hand and arm and general sepsis	
b Middle palmar space and ulnar bursa	
c Tenosynovitis and necrosis of bone of index finger	
d Tenosynovitis and multiple abscesses of arm	
e Diffuse cellulitis of hand and arm	
f Tenosynovitis, middle palmar abscess and necrosis of bone	
g Thenar space middle palmar space and ulnar bursa (the 5)	
h Tenosynovitis and middle palmar space	
i Superficial abscess of hand lymphangitis and axillary abscess	
j Superficial abscess of hand lymphangitis axillary abscess and subclavicular and subcapular abscess of chest wall and general sepsis	
k Lymphangitis axillary abscess and subclavicular abscess of chest wall	
l Functional space abscess and necrosis of bone	

The operative procedure and the general and local treatment employed in these cases will be dealt with in a subsequent paper.

CONCLUSIONS

The treatment of hand infections therefore, in order to give the best results from every viewpoint must include—

1 The proper preventive measures especially the prophylactic use of tincture of iodine and the early reporting of all minor injuries.

2 The treatment of hand infections as a serious surgical condition from their inception, and whenever indicated the adoption of hospital treatment early.

3 The proper and early diagnosis of the type and nature of infection and the exact location of the pus.

4 A proper incision of the abscess in order to establish adequate drainage and yet not spread the infection to other spaces.

HYSTERICAL JOINT NEUROSES

WITH ESPECIAL REFERENCE TO THE HIP, AND REPORT OF A CASE SIMULATING FRACTURE OF THE NECK OF THE FEMUR

By CARL W. RAND, A. M., M. D., CHICAGO

HYSTERICAL manifestations are so myriad and varied that it would be unfitting to attempt a classification of them here. The purpose of this communication is simply to place emphasis on one of the more uncommon phases of hysteria, namely, joint neurosis, with especial reference to the hip.

Sir Benjamin C. Brodie (1) was perhaps the first to call attention to this subject in 1837. In his "Pathological and Surgical Observations on the Diseases of the Joints" he alludes to "neuralgia of the joints," implying by the term neuralgia "the fact that pain is referred to a part which is not the actual seat of the disease." Brodie considered that "neuralgia of the joints" might arise from different circumstances, regarding an "hysterical state or constitution" as by far the most frequent cause. He states that though men are not exempt, the condition is more commonly seen in women, "especially in young women of the more affluent class of society, living in hot rooms, taking little exercise in the open air, and of self-indulgent habits." He fully realized the difficulty of accurately separating these hysterical conditions from other forms of organically diseased joints, stating that he was sensible of having erred frequently in diagnosis. The French have been quick to recognize the importance of his observations, referring frequently to neuromimetic joint affections as "coxalgie hystérique," "maladie de Brodie," etc. Fautou (2) gives a scholarly general review under the title "La coxalgie hystérique."

Attention was later called to this subject by Robert, 1860 (3); Barwell, 1861 (4); Giraudeau, 1865 (5), and in 1867 by Sir James Paget (6) in the *British Medical Journal* under the startling title "Cases that Bone-Setters Cure." Paget likewise was undoubtedly impressed by the teaching of his famous

predecessor. He remarks "An hysterical joint is, indeed, sometimes a rare opportunity for a bone-setter. Cold, weak, useless for want of power of will, intensely sensitive, subject to all the seeming caprices of a disorderly spinal cord and too vivid brain, such a joint as this may be cured by the sheer audacity with which it is pulled about — and so not only bone-setters, but the workers with mesmerism, and tinctures and oils, and distant or superficial electricity, can sometimes cure hysterical joints, for the patients love to be cured by a wonder and the audacious confidence of all these conjurors is truly wonderful." Such warnings are unfortunately applicable even today.

Six years later, in his "Clinical Lectures and Essays," Paget (7) devotes several chapters to the subject of "nervous mimicry" in joints, alluding to the fact that the more or less acute inflammations are most often imitated and are perhaps most commonly confused. He concludes "But, after all, the sign most to be relied on for diagnosis between real and nervous disease of joints is the temperature — a joint that is cold by day and hot by night is not an inflamed joint, that is certain."

It is not the object of this paper to enumerate the symptoms of joint diseases in general, nor does the discussion of the various metastatic arthritides of the Charcot joints of tabes dorsalis, or of other organic neuropathic disturbances of joints lend itself here. These hysterical conditions are found in the same relative frequency among the joints most often the seat of organic disease. Various authors agree that the knee joint is most often affected, the hip, wrist, shoulder and ankle joints following in order of frequency. Paget states that any joint may be the seat of "nervous mimicry" after an injury, he having seen it "in the elbow, shoulder, cervical spine, hip, knee, and ankle." He considered the



Skiagram of right hip. Showing normal relations of the hip-joint and absence of fracture of the head, neck, or trochanter

hip and knee most frequently affected, next "the tarsal and carpal joints, or the elbow and shoulder, but in these, mimeries are too rare for counting."

The onset may follow immediately upon an injury though more frequently an "incubation period of 'psychic meditation'" (Barker, 8) may elapse before active symptoms appear. Neu (9) considers pain the most prominent feature, which is intensified by movement and apparently due to a hypersensitive condition of the skin simulating the joint area rather than to any direct changes in this structure itself. Fuchs (10) describes the pain as sudden, burning and paroxysmal, and states that it may even lead to amputation or resection of the joint in question. Brodie (1) sums up the condition admirably: "The symptoms may frequently be traced to the circumstance of the patient's attention having been anxiously directed to a particular joint. Sometimes they have followed a blow or wrench or some very trifling injury. At first there is pain referred to the affected joint, of which the patient complains in different degrees not only in different cases, but even in the same case at different periods.

Often, if her thoughts are occupied by some other object of interest, she seems to forget the pains altogether, although there is no doubt that at another time she suffers severely. . . . The joint is tender, but the tenderness is peculiar also, a light touch, or even pinching of the skin, will often cause more pain than a firm and steady pressure, causing the patient to wince and even exciting motions very similar to those of chorea; another very characteristic symptom is that whatever the pain may be during the day it does not awaken her from sleep at night."

The difficulty in diagnosis is very real because the same factors may exist for the organic and for the imitated joint affections. The presence of pain, stiffness, contractures, local elevation of temperature and swelling, disuse, subsequent wasting of the extremity in question, and even systemic fever — any or all of which may occur in true joint disease — may also be present in hysterical joint neuroses. The injury may not seem adequate for the trouble that ensues, and a suspicion of neuromimesis should be entertained if pain sets in with full severity immediately after a trifling injury.

A simple but efficacious means of differentiating between true and feigned disease is offered by careful examination of the joint in question with the patient under surgical anesthesia. When the patient is deeply anesthetized, the joint may be found to move as freely as in health, but in an organically diseased joint the muscle spasm protects the movement of the joint before the patient has regained consciousness, while in the mimic disease no effort of protection is evidenced until full consciousness is restored. Charcot advised the use of chloroform as an aid in differential diagnosis on the basis that in psychoneurotic joints the skin tenderness returns first while in those the seat of organic disease deep joint tenderness ensues. Today the aid of roentgenology should always be sought when there is any question of joint disease. In the case reported below the diagnosis was readily established by skiagrams of the hip in question carefully made at intervals.

Frequent allusions to pathological changes

present in these neuromimetic joints have been made, but no definite picture has been found constant. Brodie described a slight degree of swelling being sometimes perceptible when a joint had been for some time the seat of hysterical pain. This, however, he believed to be apparently due to "some effusion into the cells of the cellular texture external to it" rather than to changes in the joint itself. Mitchell (11) reported a case in 1885 of a girl, 16 years old, who presented marked hysterical features, the most striking of which was a contracture of the left knee, which had persisted for about three years. The knee became swollen, measuring one inch more in circumference than its fellow, it was red, shining, exquisitely tender. "It was certainly unlike a synovitis, and still more unlike articular osteitis, nor did it resemble anything known to the books." Billroth and Nothnagel considered it organically involved, the former suggesting that "fungus products" would be found in the joint. Prof. Henry Sands, of New York, subsequently operated, found the joint surfaces normal, and the enlargements entirely due to inflammatory infiltration of the fatty and connective tissues surrounding the capsule. This in a measure supported the observation made by Brodie many years previously. Mitchell concludes "For those who believe that hysteria never gives rise to organic changes, this case will certainly be full of instruction." In neuromimetic joints of long duration, as in those organically diseased, muscle atrophy may exist. According to Gilles de la Tourette (12), this atrophy differs, being more general throughout the extremity with the psychoneurotic joint, while with the organically diseased joint it is localized chiefly to the adjacent muscle groups which act in moving the limb.

In reviewing the literature, so few (twenty-two) cases of hysterical affections of the hip joint alone have been encountered that it may not be amiss to enumerate them here. Many cases of hysterical neurosis involving multiple joints are on record. Only those of the hip will be mentioned, and among them the reader will note with what great conformity an inflammatory condition is simulated. The conditions cited have usually,

but not always, followed a trauma. The treatment consists largely of reeducation, application of cautery, generally helpful suggestion, hypnotism, carefully supervised extensions with gradually increasing exercise as the patient's confidence is gained, etc. The diagnosis has been confirmed in many instances by examination of the joint with the patient under surgical anesthesia.

CASE 1. Maere (13) in 1887 reported a case in a girl of 16, admitted to the clinic of Prof. Cock, presenting symptoms of hysterical contracture of the left hip, following a fall downstairs. There was an apparent shortening of 4 cm., abduction, and contractures. Under chloroform anesthesia the joint was found to be normally mobile, and the patient left the hospital. Seven days later, following fatigue, the same symptoms returned. Contracture again disappeared during chloroform and returned on awakening. Hyperesthesia on the right, anesthesia on the left, and radiating pains ensued. Medication was of no avail and therefore was discontinued. She remained in this condition three weeks, then all of the symptoms suddenly disappeared, and she was again able to walk and even to run without difficulty.

CASE 2. Peckham (14) in 1893 reported a case of "Hysterical Hip joint Successfully Treated by Hypnotism." The patient, a girl of 18, fell in a woolen mill on July 5, 1892. She was rendered unconscious, and injured her right hip and right side of her head. She walked home and remained in bed two days. One month later the right hip became painful and tender and kept her awake nights. She was first seen in May, 1893, the case diagnosed as purely hysterical, and hypnotism resorted to as a therapeutic measure. After twelve sittings the case was discharged as cured in August, 1893, practically fifteen months after her injury.

CASE 3. Fort (15) in 1894 reports briefly two cases of hysterical joint neurosis, the first in a little girl, age not stated, in which the hip was affected. The condition presented symptoms similar to those seen in tuberculosis of the hip. There was no definite history of trauma preceding. The result is not stated. The second case was in a woman of twenty in which the knee was affected. Fort's report includes Agnew's tables of differential diagnosis between pseudo arthritis and arthritis.

Holtz (16) in 1895 presented a comprehensive review of the subject in his monograph, "Zur Kenntniss der Gelenkneurosen, etc." In this contribution he reviews the literature and gives abstracts of cases of various joint neuroses. He cites Charcot as describing the first case of a hysterical joint in a man, and M. Glorieux, 1888, the second case in a soldier at the Academy of Medicine of Belgium. He does not state that either of these cases involved the hip joint. The following eight cases of hip neuroses are taken from Holtz's monograph.

anus, with satisfactory control to the patient when no diarrhoea existed. If in the male the posterior median incision, with removal of the coccyx and part of the sacrum, when necessary, will be the operation of choice.

When, however, the carcinoma is one of the higher-lying variety, palpable to the finger, but its extent not to be thus determined, an entirely different proposition then obtains. Here opinion is divided as to whether one of the extensive Kraske operations should be made, or whether the attack should be through the abdomen, or a combination of the two be utilized. When invited by your president to take part in the symposium planned for this evening, it was to this particular type I promised to respond, and that with special reference to the technique of construction of a permanent more or less satisfactory anus præternaturalis.

Personally, my experience has convinced me that in the majority of such cases the safety of the patient is best conserved by a two-stage operation, in the small minority the work can be done at one sitting. Final determination as to the procedure of choice should only then be made, when the abdomen has been opened by a median suprapubic incision sufficiently large to permit a free palpation of the entire abdomen and pelvis, for then only can one be reasonably justified in subjecting a patient to a procedure that among the best of operators has a mortality between 10 and 15 per cent, and permanency of cure of half its mortality. With the abdomen open, the first search should be for metastases, in the retroperitoneal glands and omentum, since here the lymph channels lie, in the liver, since the portal circulation alone of all the venous systems seems to transport the infective elements of cancer, in the neighboring pelvic organs, since both by direct invasion, and by contact implantation, they may become involved. In the event of inoperable metastases no attempt at removal of the rectal carcinoma should be considered and the decision then be made between a permanent or temporary anus—permanent, if there remains no chance of an anastomosis above and below the obstruction, as can sometimes be done with the small circular

carcinoma; temporary if, after an existing or recent ileus, there seems to be reasonable hope of relief later by major surgery, the intestinal toxæmia having been relieved. Since the major part of these high-lying carcinomata coming to me were suffering with an acute or chronic ileus, I have been more frequently compelled to pause with the simple relief of their obstructive symptoms; when I have attempted more I have often regretted it. That this is so, is due to the fact that the first emphatic symptom compelling attention is to the diminished lumen of the gut. Should the obstructive symptoms be overcome and the diagnosis be made prior to the opening of the abdomen, it may sometimes be feasible to have the patient in fit condition for the radical operation at the first sitting. However, inasmuch as a successful circular suture of the rectum is the exception (particularly so if the faecal flow is immediately established) I incline strongly to establishing *temporary* inguinal colostomy in those cases in which resection with circular suture is contemplated. In those cases in which circular suture does not seem feasible then the establishment of a permanent inguinal colostomy, after section of the bowel as *low down* as is consistent with inversion of the distal end, the latter being loosened laterally and posteriorly, then pushed low on the sacrum. This should then be covered with as much peritoneum as possible, some of the gap being filled in by the sigmoid loop, properly named by Jonnesco the pelvic colon, and the abdomen closed. Two to four weeks after the establishment of the new anus, the growth can be removed by the sacral route, without fear of the establishment of a faecal fistula or the fatal sepsis that too often attends the failure to divert the faecal stream.

I am heartily in accord with the Mayos, both of whom believe the patient's desire for a sacral or perineal anus is one of sentiment, and not borne out in practice as best, for the incontinent anus here can never be as well controlled, cleaned, or cared for as can the properly constructed left inguinal colostomy. This group does not include those *few* cases in which the anal and internal sphincters with an inch or more of bowel being unin-

vaded, can be preserved for junction in one of many ways with the mobilized rectosigmoid. I say *few*, because many disappointments as to competency have been observed after the most perfect junctions of this type have been obtained surgically. It is now conceded that the rectosigmoid loop is the natural receptacle for the feces prior to escape. Since this loop cannot act as a storehouse when straightened and stretched down to the perineum, the sacral anus is more often incompetent than the inguinal.

When presenting, in May, 1894,¹ my recommendation of the muscle-splitting incision I called attention to the many situations in

¹ Chicago Med Rec 1894 November

which this procedure might be utilized and began early to adapt it to the inguinal anus. Bailey improved the procedure by channeling beneath the skin for an inch or more to the left and suturing the gut to the margin of a second skin incision. To Senn I am inclined to give the credit for the suggestion that this incision should lie to the outer side of the line between the anterior superior and anterior inferior spines, since here we have a bony background against which pressure can be made for control of the fecal escape. Moreover, at this level, a low-lying belt girdling the pelvis remains in place, slipping neither up nor down, beneath which the pad can be placed which shall control the new anus.

MORTALITY AND PROGNOSIS IN OPERATIVE TREATMENT OF CANCER OF THE RECTUM¹

BY CARL B. DAVIS, M.D., F.A.C.S., CHICAGO

THE results of operative treatment of cancer of the rectum vary with the location of the growth and with the type of operation. Under results we must consider immediate mortality, recurrence, and sphincter control or its best substitute. The judging of any particular procedure on the basis of one of these factors has led to the great diversity of opinion among surgeons. The indications for this or that operative method have not been worked out to a commonly accepted technique, one surgeon feeling that a posterior operation with low mortality and great probability of recurrence is preferable to an abdominal operation with a higher immediate mortality and smaller probability of recurrence.

Some operators favor a technique that demands a termination of the bowel on the abdominal wall where other surgeons, chief among whom is Hochenegg, make every effort to bring the bowel down to some form of posterior termination. The great variation in the mortality rate of the combined operation is due to several important factors

Some operators do the abdominal step only as a secondary makeshift in cases where they have found it impossible to remove all the disease after starting with the Kraske or sacral route. In such cases infection is carried from the sacral wound soiled by the escape of feces to the abdominal cavity. Where the abdominal work is done first, designedly, the danger of sepsis is avoided. Again, cases that are desperate risks—inoperable by the sacral route—are attempted by the combined route, and when lost are charged against the method. Statistics of the past were created by men who were trained in the old technique and would not use the combined operation where there was any possibility of employing some posterior operation.

In a rough way operative treatment is divided into two groups: one for disease low in the rectum, and a second for disease high in the rectum. Some form of posterior operation is commonly used where a tumor lies so low in the bowel that its upper border is palpated by the examining finger. Mayo advises, however, where the ampulla of the

¹ Read before the Chicago Surgical Society April 2, 1913. (See p. 536 for discussion.)

rectum is involved that it is better to remove the entire rectum because of recurrence. According to statistics from several clinics we find the perineal route shows a mortality varying from 5 to 12 per cent. Where the upper margin of the tumor lies above the tip of the examining finger, either a Kraske operation with 12 per cent to 18 per cent mortality or a combined abdominoperineal operation is used with an immediate mortality of 18 to 24 per cent, according to various authors. Terminating the bowel on the abdomen has shown a great reduction in the mortality rate. Interference with the blood supply in the endeavor to loosen and bring down the sigmoid colon to a sacral or perineal anus has been the cause of a high mortality from gangrene of the stump with secondary peritonitis. The higher the growth the more difficult it is to bring down sufficient sigmoid for the posterior anus. The surgeon realizing the difficulty has resorted to the combined operation and freed the bowel through the abdominal incision and then terminated the procedure with a posterior anus. If with the abdominal procedure in high rectal disease the bowel is always brought through the abdominal wall to an inguinal anus the mortality rate will surely fall. This has actually occurred in the statistics. Abdominal perineal one stage operation showed a mortality of 35 per cent while those cases operated upon with a preliminary colostomy showed a mortality of 13 per cent. This last percentage is as low as the work of Hochenegg who is the great advocate of the posterior operation. The immediate mortality of the two stage combined operation shows an increase of only 5 or 6 points as compared with the average of all the posterior operations.

Recurrence has been very high in the literature. There is no effort in many of the larger statistics to distinguish between recurrence in the posterior operations and in the combined operation. Many authors remark on the small number of recurrences with the posterior ratio, but fail to give their figures. Hartmann, of Paris, in a compilation of cases from the French, English, German, and American literature, finds a mortality of 37 per cent for the combined operation, and a mortality of 15 per cent for the posterior operation. The recurrences in the cases operated upon by the combined operation he found to be 18 per cent while the recurrences in the posterior operation were 68 per cent. Thus 37 per cent mortality plus 18 per cent recurrence gives 55 per cent dying from cancer when handled by the combined technique against 15 per cent immediate mortality plus 68 per cent recurrence or 83 per cent dying from cancer when operated by a posterior operation.

Function following operation is an important element to the patient. Preservation of sphincter control is ideal but can be obtained only in the low-lying cases, as a rule. When the decision is left to the patient, there is always a demand that if a normal anus is unattainable then a termination of the bowel be obtained as near to the normal site as possible. The suggestion of an abdominal anus is repugnant. This decision should not be left entirely to the impression of the patient. With an abdominal anus we may promise better cleanliness because the field is controlled by aid of the sight and not the sense of touch alone, and with a properly constructed abdominal termination there is in many cases almost ideal control by means of apparatus.

END-RESULTS OF A SERIES OF THREE HUNDRED OPERATIONS ON THE GALL-BLADDER¹

By J J BUCHANAN, M D, F A C S, PITTSBURGH

THE three hundred operative cases of gall-bladder disease which I shall consider in this paper are consecutive, and comprise all such cases as are not too recent to be properly included¹

The present inquiry into the subsequent history of my gall-bladder patients was prompted by a growing feeling of dissatisfaction and uncertainty as to the ultimate outcome of the drainage operations which I have so generally practiced. This feeling arose from the return of an occasional patient who proved not to have been cured, and, what was still more disquieting, the information that a few others had been operated on a second time elsewhere.

About a year ago I instituted an investigation to find out, for my own instruction, just what results I had been getting for years back, and at the same time I watched the literature for end results reported by others in similar series of cases, noting also the practice and opinions of surgeons of large experience.

Starting, where we must all start, at the Mayo Clinic, I find that at St. Mary's Hospital, during the year 1914, of a total of 849 cases of operation on the gall-bladder alone, 708 were excised—83½ per cent—and that all of the 140 cases that were drained were cases of acute cholecystitis, with or without stone.

This very radical practice was foreshadowed by the paper of W J Mayo in the *American Journal of the Medical Sciences*, April, 1914. He there stated that while cholecystotomy may be an efficient procedure in gall-stone disease when the gall-bladder is otherwise normal and the ducts are free, in cholecystitis the method is not satisfactory. A gall-bladder which can keep up continuous trouble from infection alone, without the mechanical irritation of gall stones, will probably not be

cured by simple drainage, and cholecystectomy will be the procedure to follow. "As a matter of fact," he says, "cholecystectomy is now largely indicated in gall-stone disease, and it may be said that practically all cases of cholecystitis and the large majority (probably 80 per cent) of cases of gall stone disease should be treated by cholecystectomy rather than cholecystotomy."

John R Deaver, in a paper read two years ago at a meeting of the Springfield Massachusetts Academy of Medicine said "The subject of cholecystectomy is not one to be lightly considered or easily decided. My own experience with these operations, their relative mortality and curative effects, inclines me to be rather more radical than hitherto. I would still counsel the inexperienced surgeon to cling to cholecystotomy. I have, however, had enough disappointments with cholecystotomy to believe that there are cases in which I should remove the gall-bladder, provided only that I am able to select them at the time of operation."

In most cases of acute calculus cholecystitis, I remove the gall bladder. I do not remove gall-bladders simply for old chronic changes unless the organ is practically destroyed and valueless or dangerous in appearance from the standpoint of malignancy.

Temporary improvement is the rule after cholecystotomy. Permanent cure results in the majority of cases, but in the chronic infection carriers, cholecystectomy is more reliable from the standpoint of the ultimate result. The removal of the gall-bladder may be a matter of extreme simplicity or of the greatest difficulty. As a rule, the stronger the indications for cholecystectomy the greater the operative difficulty."

George W Crile, in a paper published in *Surgery, Gynecology and Obstetrics* in April, 1914, stated "No adverse effects from cholecystectomy have been seen provided

¹ Credit and thanks are due to the writer's assistant Dr N P Davis for efficient aid in abstracting these cases.

² Read before the American Surgical Association, Rochester, Minnesota, June 10, 1915.

the division is made at the beginning of the cystic duct, that no gall-bladder is left, and that the division does not at all encroach on the common duct.

If acute infection be present, then, in most cases, cholecystostomy should be first performed, followed, if required, by a later cholecystectomy. If the gall-bladder and the cystic duct be approximately normal, then the gall-bladder should be left. If the gall bladder be thick, contain much scar-tissue, be shrunken, show chronic infection of the wall, if the cystic duct be partially or completely strictured, or if a stone be impacted in the duct, then cholecystectomy should be performed."

It will be noticed that the practice of these three operators differs widely in their choice of operation, and this is typical of the wide range of opinion on this subject. Contrary to what is generally believed and taught, I think the gall-bladder has remarkable powers of recuperation. As I look over the records of my cases and observe the ravages of stone, of acute and chronic inflammation, including empyema of all grades and the cases of seeming gangrene of the mucosa, and follow the history of these same patients for years afterward, I am amazed at the resources of nature.

I believe that the fate of the drained gall-bladder that is not totally gangrenous (and totally gangrenous cases are exceedingly rare) lies in the perviousness of the cystic duct. If it is obstructed by an overlooked stone, or by a pressure-necrosis stricture from a previously impacted stone, then that patient stands a poor chance of a cure by drainage only. I believe that no operator can always know the condition of the cystic duct. If the bile flows freely through it during the operation, the probability is great in stone cases and acute inflammations that the gall-bladder will be restored to its function, whatever that is.

If the bile does not flow and a probe, as is usual, cannot be carried into the common duct, no one can tell whether this is due to a small overlooked stone, an organic stricture, or, what is most common, congestion of the mucous and submucous coats of a tortuous duct.

If any surgeon feels that he must make sure of every case, then he must remove every gall-bladder, and unless he be possessed of rare skill I believe his immediate mortality from cholecystectomy will far outbalance the morbidity of his uncured cases.

The worst that is likely to happen is that the patient is not cured and that he must be reoperated upon for the removal of a hopelessly crippled organ that is permanently out of commission. This is not pleasant, I will admit, either for the patient or the surgeon; but we must remember that it is not a common occurrence, and becomes more rare as the surgeon's skill increases.

The increase in risk of a secondary over a primary cholecystectomy seems to me to have been too greatly emphasized by many surgeons. I think they have been comparing different kinds of cases — the primary cholecystectomy in simple cases and the secondary cholecystectomy in difficult cases — cases in which a cholecystectomy would have been most dangerous as a primary operation and which as a secondary operation are difficult, not because the gall-bladder has been drained, but because it and the contiguous structures have been subjected to such violent pathological changes before the first operation was performed.

I am, therefore, disposed to think with Crile that in the severe, acute infections, the gall bladder should be primarily drained, and in the cases not thus cured it should be subsequently removed. I believe this to be the practice also at the Mayo Clinic, where last year 140 cases of acute cholecystitis were drained, out of a total of 849 gall bladder cases.

I have included in the list of cases considered in this paper all those in which the gall-bladder alone was involved in the disease, and also those in which the gall-bladder only seemed to be involved, but subsequent events proved that an overlooked stone existed in the common duct. I have included the acute cases of cholecystitis with or without stone comprising 32 per cent of the entire number, taking in the cases of empyema of the gall bladder, of which there were 55, and the cases of total gangrene, of which there were

but 2. I have included also the chronic cases of cholecystitis without stone and the chronic cases of stone in the gall-bladder, whether or not the gall-bladder was evidently diseased. I call attention to the large proportion of acute cases.

I have omitted from the list the cases in which I have operated secondarily, the primary operation having been done elsewhere. I have also omitted the cases in which stone was found in the common duct at time of operation.

As to the conditions present in my cases of cholecystitis, whether or not caused or complicated by stone, I would say that I have regarded a case as acute if the gall-bladder presented the usual appearance of acute inflammation, namely, redness and thickening, with perhaps sponginess and friability.

I have applied to the quiet cases an equally simple test, such as we are accustomed to apply to the appendix, namely, that they should be considered cases of chronic inflammation only if they were thick, white, fibroid, atrophied, adherent, strictured, or hour-glass. In the chronic cases that require microscopical proof and the strawberry gall-bladder, my experience has been too limited to be of any value. Perhaps some of the cases which do not appear in my records as gall-bladder cases at all, in which I have examined the gall bladder and considered it normal, may really have been of this type and should have been subjected to cholecystectomy. I do not know. I have no knowledge that any of these cases subsequently developed stones or were proved by operation to be pathological.

Of the 300 cases recorded in this paper, all have been traced but 18, giving 94 per cent of known results.¹ Many patients have been examined, many have replied by letter, and many have been reported on by their family physicians or by other medical men in the same town when the original attendant had died or moved away.

Without the kind assistance of these confreres no such approach to completeness of knowledge could have been attained.

¹ To the industry and perseverance of the writer's secretary, Miss M. Crider, is due the success in locating such a large proportion of these patients.

The cases that are designated as "satisfactorily cured" are such as appear, by the most careful scrutiny of the information secured, to have been completely relieved of symptoms referable to the bile tract. Those stated in the tables to have had unsatisfactory features in their subsequent history (12 per cent of the total number of cures) are set down in detail in a separate table. The uncured cases also are fully exploited in a table of their own.

The immediate and late results of the cases in this series are given in the following tables.

CHRONIC GALL BLADDERS CONTAINING STONE, TREATED BY DRAINAGE

Cured satisfactorily	99	
Cured, but with some unsatisfactory features	16	115
Not cured		13
Not traced		10
Died		5
		143
		Per cent
Cured in the traced cases	86	5
Not cured in the traced cases	9	8
Died	3	5

CASES OF ACUTE CHOLECYSTITIS AND EMPYEMA WITH STONE TREATED BY DRAINAGE

Cured satisfactorily	42	
Cured but with some unsatisfactory features	8	50
Not cured		14
Not traced		3
Died		6
		73
		Per cent
Cured in the traced cases	71	4
Not cured in the traced cases	20	
Died	8	3

GALL BLADDERS CONTAINING STONE TREATED BY EXCISION

Cured satisfactorily	9	
Not cured	1	
		10

CHRONIC CASES OF CHOLECYSTITIS WITHOUT STONES TREATED BY DRAINAGE

Cured satisfactorily	38	
Cured but with some unsatisfactory features	4	42
Not cured		4
Not traced		2
Died		1
		49
		Per cent
Cured in the traced cases	80	4
Not cured in the traced cases	8	5
Died		2

ACUTE CASES OF CHOLECYSTITIS AND EMPYEMA WITHOUT STONES TREATED BY DRAINAGE

Cured satisfactorily	12
Not cured	4
Not traced	3
Died	2
	21
	Per cent
Cured in the traced cases	66 6
Not cured in the traced cases	22 2
Died	9 5

CASES OF CHOLECYSTITIS TREATED BY EXCISION

Cured	4
Total number of cases	300
Died	14
General mortality, per cent	4 66

SUMMARY

GALL-STONE CASES CONSIDERED CURED BUT WITH UNSATISFACTORY FEATURES

Slight persisting indefinite pains 4 cases
 Indefinite abdominal pains which have ceased, 2 cases
 Severe abdominal pain attributable to other cause, 1 case
 Persistent pains of an ephemeral nature 1 case
 Pains in region of gall bladder for a time but later well, 2 cases
 One severe attack, but perfectly well for last 15 years, 1 case
 Conflicting reports about pain after operation Well now several years 1 case
 Persistent slight drawing sensations, 2 cases
 Drawing sensations which have ceased, 1 case
 Dyspeptic symptoms, 1 case
 Delay in closure of fistula, 3 cases
 Prolonged drainage from common duct after cholecystectomy followed by spontaneous closure, 1 case
 Spontaneous passage of gall stones from fistula after return home, 1 case
 Hernia, 3 cases

CHOLECYSTITIS CASES CONSIDERED CURED BUT WITH UNSATISFACTORY FEATURES

No attacks, but considerable pain for first year Well for last six years, 1 case
 Occasional pains for a time beginning at splenic flexure Quite well now, 1 case
 Slight pains persist, no severe pains such as existed before operation, 2 cases

CHRONIC GALL-STONE CASES NOT CURED BY DRAINAGE

CASE 1 Woman, age 69, operated upon in 1905 Cholecystectomy was performed six weeks later by a surgeon in a neighboring town, who found a single stone, probably impacted in the duct She remained well thereafter Primary cholecystectomy would almost certainly have cured this patient

CASE 2 Man, age 40, operated upon in 1909 The gall bladder was opened about three years later by another surgeon and 6 or 8 good sized stones removed The gall bladder was drained at this second operation The subsequent history is not positively known Primary cholecystectomy would probably have cured him

CASE 3 Woman, age 23, operated upon in 1897 Returned four months later with persistent sinus

Fragments of stone were removed with a scoop and she is believed to have been cured, but cannot now be traced Primary cholecystectomy would almost certainly have cured her

CASE 4 Woman, age 33, operated upon in 1903 Persistent sinus known to have been present 21 months later Patient then passed from observation Primary cholecystectomy would almost certainly have cured her

CASE 5 Woman, age 54, operated upon in 1909 Colics persisted for two years She has been perfectly well for the last four years Cholecystectomy would perhaps have cured her

CASE 6 Woman, age 52, operated upon in 1914 Returned two and a half months after her drainage operation with a thickened gall bladder without stone Secondary cholecystectomy was performed Her subsequent history could not be traced Primary cholecystectomy would have obviated the necessity for a secondary operation

CASE 7 Woman age 28, operated upon in 1903 Had repeated attacks of colic for next two years and her subsequent history is unknown Cholecystectomy would probably have cured her

CASE 8 Fat, flabby and jaundiced man, age 47, operated in 1909 Common duct thickened and enlarged, but no stones to be found in it Stones in gall bladder and cystic duct Fistula reopened several times opening preceded by pain Patient has been well for the last year Cholecystectomy would probably have prevented his subsequent attacks

CASE 9 Woman operated upon in 1909 Remained well for a year, and had four slight attacks in the next five years Cholecystectomy might have been a better operation in this case

CASE 10 Woman, age 27, operated upon in 1909 Gall bladder drained for empyema one year later and again four months afterward Patient has been well for four and a half years Cholecystectomy would have been a better operation

CASE 11 Woman, age 36, operated upon in 1906 Cholecystectomy performed two months later and a single stone found impacted in the cystic duct One year afterward this patient was operated upon in another hospital for adhesions and she is now in a third hospital said to be suffering with the same condition Secondary cholecystectomy did not cure this patient

CASE 12 Man operated upon in 1908 Remained well three and a half years and died of contracted kidney a year later The only reason for entering him in the uncured list is that his physician's diagnosis was cirrhosis of the liver Cholecystectomy would not have prevented his later illness

CASE 13 Woman, age 50, operated upon in 1905 The patient had been seriously ill for two years and in that time had lost 113 pounds (weight on admission 87 pounds), and for a year had had a diarrhoea with four to ten stools a day She died a month after discharge from the hospital Cholecystectomy could not possibly have made any

change in this case, as her operation was merely an incident in the course of a fatal disease

ACUTE GALL-STONE CASES NOT CURED BY DRAINAGE

CASE 1. Woman, age 69, operated upon in 1912 Empyema with one impacted stone. *Several attacks in next few years, but now seems to be well*

CASE 2. Woman, age 56, operated upon in 1907 Empyema with many stones. *Delayed closure of sinus. Five years later, sinus reopened and drained for a few weeks. Had three attacks last year, but is now well*

CASE 3. Woman, age 33, operated upon in April 1914 Empyema with three stones. Sinus did not permanently close for six months, by reason of *two overlooked impacted stones*, which were then removed by means of sponge tent and scoop. Patient has since remained well

CASE 4. Woman, age 39, operated upon in 1909 Empyema with one stone. Well for six or eight months. Then some *cramp* in region of gall bladder and a *hernia* developed

CASE 5. Woman, age 36, operated upon in 1911 Complaints three and a half years later so indefinite it is impossible to say whether gall bladder is at fault

CASE 6. Man, age 60, operated upon in 1910 Empyema with stones. One stone in cystic duct had to be abandoned. Gall bladder opened in another hospital for empyema in 1912. Recently examined and *still has some discomfort*

CASE 7. Man, age 46, operated upon in 1911 Gall bladder apparently gangrenous. Operation had to be completed rapidly. Stones picked from sinus later. *Reoperated upon for adhesions two and a half years later. No more attacks, but some stomach symptoms*

CASE 8. Woman, age 59, operated upon in 1910 Empyema with stones. Stones scooped out two months later. Three years later *drained under local anesthesia for chronic pancreatitis. Diabetic*

CASE 9. Woman, age 40, operated upon in 1900 Empyema with stone. Stone overlooked. Cholecystectomy in an Eastern city. Frequent attacks of jaundice after this second operation

CASE 10. Woman, age 56, operated upon in 1909 Empyema with stone. *Operated later elsewhere. Nature of operation and later history unknown*

CASE 11. Woman, age 35, operated upon in 1913 Empyema with stone. Cholecystectomy seven months later for intermittent sinus with pain. *Sinus still persists, but she is now free from pain*

CASE 12. Woman, age 41, operated upon in 1912 Empyema with stones and duodenal ulcer (Gastro-enterostomy also done). Operated upon a year or more later at another hospital. Cholecystectomy with ligation of pylorus. *Symptoms not relieved by secondary cholecystectomy*

CASE 13. Man, age 42, operated upon in 1905 Empyema with stones and deep jaundice in a very weak man. Stones probably left in the common duct. *Stones removed seven months later by a surgeon in the West, with fatal result*

CASE 14. Man, age 29, operated upon in 1912 Acute cholecystitis with stones. Still has *pains*, thought by his physician to be from his appendix, which was not removed

GALL STONE CASE NOT CURED BY EXCISION

CASE 1. Woman, age 33, operated upon in 1907 Excision followed by persistent biliary fistula, no doubt due to inclusion of part of common duct in ligature. *Secondary operation ten months later for reconstruction of structured common duct*, followed by death from hemorrhage notwithstanding transfusion

CHRONIC CHOLECYSTITIS WITHOUT STONES NOT CURED BY DRAINAGE

CASE 1. Man, age 25, operated upon in 1912 Dyspeptic symptoms persist

CASE 2. Woman, age 36, operated upon in 1909 Spent most of next two years in bed, probably from some other condition, as no details were secured

CASE 3. Man, age 41, operated upon in 1908 Had several attacks of colic in next six years

CASE 4. Man, age 58, operated upon in 1908 Chronic pancreatitis. Common duct drained and sinus persisted for a year. Patient has since been well (five and one half years)

ACUTE CHOLECYSTITIS WITHOUT STONES NOT CURED BY DRAINAGE

CASE 1. Woman, age 57, operated upon in 1911. Gall bladder atrophied with small abscess extracystic. *Milder attacks since operation*

CASE 2. Man, age 47, operated upon in 1912 Empyema without stone. Cholecystectomy about a year later by another surgeon. Result unknown

CASE 3. Woman, age 44, operated upon in 1905 Empyema. Very prolonged recovery, probably from an overlooked stone in the common duct, entirely well for four years past

CASE 4. Woman, age 48, operated upon in 1912 Empyema. One year later became jaundiced and was very ill. Passed a stone by bowel and has since been well

The question may very properly arise as to why 95 per cent of the cases in this series have been drained and only 5 per cent excised. The answer, I think, has a temperamental basis and the principal reason is a certain conservatism or timidity, if you will, in changing a practice which seemed to be giving fairly good results over a period of years

Of one thing I am reasonably certain, as I look back over these cases and study their histories, and that is that considering the nature of the cases (32 per cent of them being acute) and my lack of experience and ex-

pertness, which was naturally a greater factor in the earlier years, the mortality would have been decidedly higher if cholecystectomy had been practiced in the majority of cases.

Analysis of the 13 uncured cases of chronic gall-stone patients shows that 10 of them would probably have been better off with a primary cholecystectomy; in four of these, stones were certainly overlooked, and in six the symptoms pointed to obstruction of the cystic duct either from stone or stricture.

Of the 14 uncured cases of acute gall-stone patients, four had stones subsequently scooped out. In these and in the great majority of the acute cases the local conditions were such that cholecystectomy was not to be considered.

In the gall stone cases 78 per cent were females, in the cholecystitis cases 66 per cent. Only two patients were under 20 years of age — a girl of five and one-half years with empyema and a girl of nineteen years with stones and a simultaneous acute appendicitis.

In exactly 100 cases was the previous occurrence or not of typhoid fever noted in the history. In 41 of these typhoid fever had been an antecedent and in 59 it had not.

No patient was known or suspected to have developed cancer of the bile tract after operation. (Graff and Weinert observed cancerous development subsequent to cholecystectomy in four of their 124 cases.)

While stone was afterward found in ten of my cases — a little more than 3 per cent — there was no good evidence that any of these was a case of true recurrence. Overlooked stone occurs in the practice of all operators in 2 to 5 per cent of cases.

Of the ten cases in which stones were here overlooked, in one, the patient cured himself by extruding 50 to 75 stones from his sinus, in one the stone was passed by the bowel, in three cases the stones were scooped from the gall bladder after dilatation of the sinus with sponge tents, in one case the stones were removed years after closure by cholecystectomy, in two cases impacted stones were removed by cholecystectomy, in one probably by choledochotomy elsewhere, and in one case the stone probably remains.

TECHNIQUE OF OPERATION

Incision was in most cases through the rectus muscle; in many of the earlier cases Kocher's incision parallel with the costal cartilages was employed, and it did not seem that the muscle section tended to hernia production.

Local anesthesia was used in a small proportion of cases and only in very weak patients. It was invariably well borne and did not prevent necessary manipulations, but, naturally, as little as was necessary was done.

The common duct was palpated in most of the cases and drained in some with the expectation of finding stone. (Common-duct stone cases are not considered in this paper.) Negative evidence concerning the contents of the common duct was never very confidently relied on.

Much reliance as to prognosis of cure was placed on the flow of fresh bile on the table and within the next few days. Note of this fact was made in 212 cases, and it was found that, when the bile flowed freely from the gall-bladder, only 8.5 per cent were not entirely cured, whereas, in the cases in which the bile did not flow at all, 45 per cent were not entirely cured.

The margin of the opening in the gall-bladder in all cases operated in the last ten years was overwhipped with a catgut suture and narrowed with a stitch so as to tightly embrace the rubber drain, making practically a watertight joint (Fig 1).

This overwhipping renders hæmorrhage from this vascular structure impossible. Whenever the fundus could be brought to the peritoneum without tension it was anchored there, and there was no complaint of discomfort to indicate that this was not good practice. I believe this ancient practice in normal cases reduces the liability to adhesions. Where the fundus will not easily reach the parietal peritoneum the gall-bladder is dropped with the tube secured as described and pictured.

The question of whether the gall-bladder is a perfectly superfluous organ can probably be safely answered in the negative on general principles. Other things being equal, therefore cholecystotomy should be preferred to

cholecystectomy in all cases. The fact is, however, that other things are *not* equal in the very cases that are under consideration. A gall-bladder that is diseased and is not going to recover is worse than none.

The gall-bladders that were drained in the present series recovered in 81.7 per cent of cases, and 5 per cent more recovered from the drainage operation to be cured by nature or the further efforts of the surgeon.

What end-results are to be expected from cholecystectomy?

Graff and Weinert¹ last year traced 124 of their 130 cholecystectomies and found that only 73.4 per cent were permanently cured, whereas Schulz² in a series of 510 cholecystectomies had been able to examine only 145 cases and makes the surprising statement that *not one* had any evidence of recurrence of the former or any other untoward symptoms.

The truth about cholecystectomy probably lies between these two views, and when the balance is struck I think it will be an uncertain quantity and will depend on the skill and judgment of the individual operator.

Tinney, with his usual acumen, struck at the heart of this question when he said, "The great objection to cholecystectomy will always lie in the fact that, in cases of subsequent obstruction to the common duct, the other avenue for the passage of bile has been cut off."

When Hans Kehr can state, as quoted by Eisendrath last year at the meeting of the American Medical Association that of 54 cases in which he had examined the common duct, in 32 palpation was negative and yet stones were found, and when Eisendrath can say that, in over half of his cases, when palpation was negative, by opening the common duct he has found stones, then we should have a lively sense of the danger of permanently closing the cystic duct and leaving stones in the common duct to block that important tube.

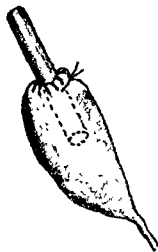


Fig. 1

CONCLUSIONS

1 Cholecystotomy is not a satisfactory operation, giving but 81.7 per cent of ultimate cures, taking the cases as they come.

2 Cholecystectomy, it is believed, would not be a satisfactory operation if employed in all cases by operators of ordinary skill and perhaps even by the most skillful surgeons.

3 The personal equation enters so largely into this question that it must be conceded by the advocates of cholecystectomy as well as the followers of cholecystotomy (if any still exist) that the practice that is safe for one operator is unsafe for another.

4 As a surgeon's experience increases and as he honestly follows his cases and considers their condition he is more disposed to turn to cholecystectomy, and at the same time he should realize that the too hasty adoption of this course may be attended with an increase in his mortality list.

5 There is a field for both operations, and that surgeon will have most success who will not only consider the condition of the patient but estimate justly his own capabilities.

¹ *Beitr. z. klin. Chir.* 1914, vol. 330.

² *Ibid.* 359.

GONORRHEAL URETEROPYELITIS; REPORT OF TWO CASES TREATED BY INJECTIONS OF ANTIMENINGITIC SERUM

BY MONTAGUI L. BOYD, M.D., ATLANTA, GEORGIA

NUMEROUS reports have been made of the treatment of complications of gonorrhea with antimeningococcus serum since Pissavy and Chauvet¹ in 1909 presented to the Societe Medicale des Hopitaux de Paris two cases treated by injections of antimeningococcus serum. Most of the cases have been of arthritis¹ and² but a number have been of epididymitis and some of septicaemia³ and acute urethritis. There has been only one case of ureteropyelitis,⁴ which was reported by Strominger to the Societe Genito-Urinaire de Bucarest in November, 1911. I find no other cases reported in the literature.

The results obtained in the treatment of the various cases of acute arthritis are reported to be very gratifying, those obtained in the cases of acute epididymitis are perhaps less striking but nevertheless are excellent and worthy of consideration. The other cases of septicaemia and urethritis are not sufficiently numerous to offer reliable statistics, and a knowledge of the value of the serum in such cases as compared to other methods of treatment can only be obtained by deduction.

The results I have obtained in the two cases of ureteropyelitis that I am here reporting are certainly most satisfactory.

CASE 1 (68 J. M. Mc—) Age 31 mechanic. Came to me April 13, 1912 complaining of aching pain in the lower back and right thigh and increased frequency of urination which came on after a gonorrhea.

Previous history is of no importance, he was well up to the time of the present illness, no venereal trouble.

Present illness began three months ago with a urethral discharge. The amount of discharge was moderate, and there was no burning on urination.

¹ Hefvescu and Coelic. J. d'urolog. Med. et Chir. 1912 p. 477.

² Hefvescu and Strominger. Verhandl. d. Deutsch. Gesellsch. f. Urol. 1913 p. 207.

³ Strominger. (Abstracts in Zisch. f. Urol. 1911, p. 304.) Note sur un cas de septicaemie gonococcique guerie par des injections de serum antimeningococcique. Ann. d. mal. gen.-urin. 1910, II, No. 21.

⁴ D. L. Strominger. Arthrite du coude et uretero-pyelite gonococciques traitees au moyen d'injections de serum antimeningococcique. Rev. clin. d'urolog. 1912 May. Summary in Zisch. f. Urol. 1912 p. 330.

During the third or fourth week after the trouble started had to get up three to four times at night to void, but says that he was drinking a great deal of water, and that the amount of urine passed each time was normal and accompanied by no unusual sensations. The discharge gradually disappeared under injections of protagol and occasional vesical irrigations of potassium permanganate solution.

About three weeks ago, when he was apparently nearly well, without apparent cause he passed some blood after urination accompanied by pain and straining. This continued for about two weeks, during which time some sounds were passed into the bladder, which seem to relieve the discomfort. Coincident with the appearance of the blood he began to void very frequently every 30 to 40 minutes, but this gradually improved and now he only gets up two to three times at night.

About two days ago during the time the sounds were being passed, he first noted an aching pain in the lower part of the back and in the right thigh. Three days later it was quite severe of a dull aching character, and accompanied by aching pain in both legs. Since two days ago the pain has been in the right buttock and has been severe enough to keep him awake at night. He feels no pain when going up and down stairs but when walking on level places there is soreness and pain in right buttock and right thigh.

During the past week he has been getting up only once or twice to void. There is practically no urethral discharge and no more blood in urine. Nearly all of the discomfort after voiding has disappeared—only a little burning left. The bowels have been kept moving freely. He has been very thirsty.

Two days ago received subcutaneous injection of gonorrheal vaccine.

Examination. Urine cloudy in all three glasses. Glasses 1 and 3 contain numerous pus-cells and gonococci. No urethral discharge. Prostate slightly swollen and feels tender to pressure than normally. No indurations or adhesions. No signs of acute inflammation or abscess. Inguinal glands very slightly enlarged. Scrotal contents normal. Pressure on the lateral portions of the pelvic bones causes pain in the right sacro-iliac joint. Pressure over this joint from behind is very slightly painful. By rectum this joint can be felt to be tenderer than the left and there is a distinct swelling over it. Temperature (M) 102.5°.

Treatment. Rest in bed. Gonorrheal vaccines given in six doses from 50 to 400 million. Temperature fell to normal within two to three days, but rose to 99° or 100° after each of the first injections of the vaccines.

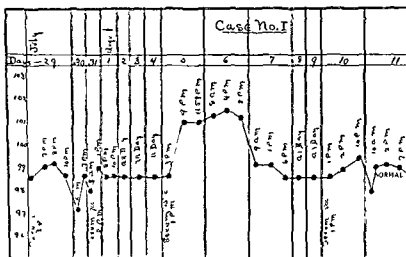


Fig 1 Temperature chart, Case 1

April 25 (12 days later) Patient out of bed today. Temperature normal. Joint much better, but still some tenderness and stiffness. Urine still cloudy in glass 3 and contains much pus and many gonococci. No reaction in the urinary tract after the injection of the vaccines.

May 5 (22 days later) Urine no less cloudy and still many gonococci. Joint still slightly sore and stiff. Voids three to four times at night but drinking much water. For past ten days has been using urethral injections and daily irrigations of the bladder with potassium permanganate.

June 21 (69 days later) Joint has gradually improved, but the stiffness and soreness has not entirely disappeared. Since the urine was still quite cloudy and there were many gonococci still present another course of gonorrhoeal vaccines was tried, beginning with 100 million and going up to 600 million. The only reaction noted after their use was sometimes an increased soreness in the joint, a slight headache, a tendency to constipation, and a rise in temperature to 99° or 99.6°, which disappeared in about 24 to 36 hours.

July 11 (88 days later) In spite of the fact that the patient has gained weight and looks to be in good physical condition the urine has remained full of pus and gonococci. He urinates one to two times at night, but there are no other symptoms of urethritis or cystitis.

Ureteral catheterization. Catheter could not be introduced into the right ureter although several kinds and sizes were used, trauma avoided as much as possible. Urine from the left contains much pus and many gonococci. Cloudy urine could be seen coming from the right ureteral orifice. Lavage left kidney with silver nitrate solution 1:10,000, practically no discomfort.

July 14 (91 days later) *Ureteral catheterization*

Urine from both sides contains much pus and many gonococci. Left orifice inverted U-shape. Right orifice swollen and puffy, more so than on the 11th. Lavage of both kidney pelvis with silver nitrate solution 1:8,000.

July 24 (104 days later) *Ureteral catheterization.* Urine from the left side is cloudier than from the right, many gonococci still present. The right orifice is less puffy. Lavage of both kidney pelvis with silver nitrate solution 1:4,000. There is only moderate burning in the bladder following kidney lavage with the silver nitrate and no discomfort felt in the kidneys.

July 27 (107 days later) *Ureteral catheterization.* Cloudy urine from both sides as before, with more cloud in that from the left. Gonococci still present. Right orifice seems more swollen than when last viewed. Lavage with silver nitrate solution 1:2,000 followed by some little burning in bladder.

July 29 (108 days later) Since there seemed to be no improvement in the kidney infection from the use of the lavages it was determined to try injections of antimeningococcus serum, therefore 5 ccm were injected into the right buttock. As a result of this his temperature rose to 99.3° within five hours, but was normal two hours after that. There was a moderate aching pain in the right sacro iliac joint and in his eyes. Slight local reaction.

July 31 (111 days later) Injection, 7 ccm antimeningococcus serum into the buttock. This was followed by no fever and no particular discomfort. Slight local reaction.

August 4 (115 days later) Injection of 15 ccm antimeningococcus serum into the buttock. Temperature seven hours later 101°. In 24 hours temperature was 101.5° but after that fell to normal by twenty four hours later. Reaction at seat of injection rather well marked, sacro iliac joint quite

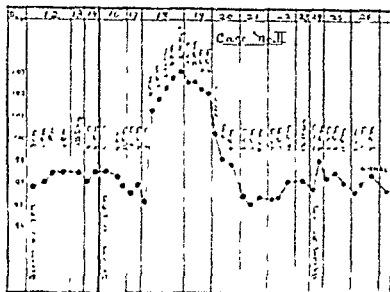


FIG. 1. Temperature chart Case I.

sore aching in back and legs rather severe. Head ache and loss of appetite. Slight urinal eruption over buttocks. Slight increased frequency of urination but no discomfort. No definite reaction to serum in kidneys.

August 10 (122 days later). Injection of 25 cc. antimentingococcus serum injected into the buttock. Temperature after this injection rose to 100.4° but no higher. Normal within 33 hours. Local reaction very severe. marked soreness swelling and induration. General reaction mild. very little soreness in sacroiliac joint and hardly any malaise.

The urine. During these injections there was from the first a gradual improvement in the condition of the urine. it became clearer after each of the first two injections, and after the third which was followed by the severe reaction it became almost completely clear. After the fourth injection it was completely free from pus and gonococci with in five days. During the time that the injections of serum were being given, local treatment was discontinued almost completely. the patient using a hand syringe for the injection of a weak solution of protargol into the urethra. Still shreds in glass 1, no organisms.

The sacroiliac joint. There was an improvement in the arthritis from the time the patient first came to me up to the time of the injections of the antimentingococcus serum. There was still however, some swelling about the joint, particularly observable by rectal palpation—a soreness which was noted on unusual muscular exertion and on squatting and stooping. After the injections of the antimentingococcus these remaining symptoms were

no longer to be found, the arthritis was apparently completely cured.

March 1913 (almost a years later). The patient has had no recurrence of either the kidney infection or the arthritis.

Case 2 (A. L. J. J. W.). Age 20 college student. Patient referred to me December 23 1912 complaining of a continued gonorrhea, with cloudy urine. Previous history of no importance. Healthy virgin man who has had no previous venereal infections.

Present illness began with a gonorrheal urethritis about seven months ago. Discharge rather profuse for three to four weeks but there was only slight burning or discomfort on voiding. At one time he had to get up two to three times at night to void this continued for a week or ten days (he was drinking a good deal of water at the time), and during that time there was a slight burning after voiding. No hematuria and no adenitis or other complication at the time.

Treatment was continued for four months (until September 1912) because of a slight discharge which would disappear for only a few days at a time. He was then considered practically well, and was operated upon for appendicitis. Very shortly after the operation there was a recurrence of the discharge and he was declared to have a pronounced gonorrheal urethritis again. Under treatment the discharge disappeared in a few days, except for a slight amount which has remained more or less constantly in evidence up to the present time.

He is able to give no information worthy of note concerning the length of time his urine has been cloudy.

The treatments which he has received have been daily irrigations of the bladder with solutions of potassium permanganate. No massage of the prostate and no instrumentation of the urethra.

Present condition: General health good. No increased frequency of urination. Slight urethral discharge and cloudy urine.

Examination, December 21, 1914. Urine cloudy in all three glasses, acid. Microscopic examination shows numerous pus cells and numerous gonococci, besides the gonococci there are a few diplococci which on repeated examinations are seen to be gram positive. Urethra presents a stricture about the midpoint of the pendulous portion — will admit a 16 F instrument.

Bladder and kidneys. A small soft rubber catheter was introduced into the bladder after the urethra and bladder had been washed out thoroughly (without instrument). The bladder was then again thoroughly cleansed and examination made of the urine which had collected in the bladder, it was repeatedly found to be very clouded with pus and gonococci. This examination was repeated after a rectal investigation of the prostate and seminal vesicles to eliminate them as sources of the organisms and pus. I was then satisfied that there was a gonorrhoeal ureteropyelitis.

January 12, 1915. Antimeningococcus serum to the amount of 4 ccm was injected subcutaneously into the forearm. There was no subsequent rise in temperature above normal, no general reaction, and no evidence of reaction in the genito urinary apparatus. At the site of the injection there was a quite marked soreness, swelling, and redness which extended 10 to 15 cm in all directions.

January 16, 1915. Injection of 7 ccm of antimeningococcus serum into the buttock at 6 p.m. No rise in temperature above normal for 48 hours. Although there was no fever on the day after the injection, there was a severe headache and backache and a general malaise. On the next day he still was quite weak and by noon the headache became very severe. His temperature was not taken after 8 15 a.m. until 4 15 p.m., when it was found to be 101.4°, and it continued to rise, until at midnight it was 103°. About 36 hours later it was normal. There was a slight increase in the frequency with which he voided, but it was not noted until my questioning brought it to his attention. Local reaction fairly well marked and areas of urticarial eruption appeared over buttocks and on both thighs.

January 23, 1915. The urine is much clearer, but still a few pus cells and a few gonococci can be found.

January 24, 1915. Injection of 5 ccm of antimeningococcus serum made into the buttock at 11 a.m. Temperature rose to 99° in the evening and was normal again the next day. Local reaction not as marked as with the preceding injection and the urticarial eruption which appeared was not as extensive and was found only on the buttock. No general or urinary reaction, no headache or malaise.

January 31, 1915. Urine very nearly clear in glasses 2 and 3, glass 1 contains some shreds which are free from diplococci, glass 3 a few diplococci which are gram positive. Meatotomy done to admit easily a 30 F sound. An 18 F sound passed as far as the bladder, but was followed by some bleeding. Injection, 5 ccm antimeningococcus serum. Temperature rose to 99° on the following day — normal thereafter.

February 14, 1915. Urine clear but for a few shreds in glass 1. Meatotomy wound healed. Prostate by rectum slightly enlarged, and contains a good many pus cells in the prostatic secretion (a moderate number of leucithin bodies), but a stained specimen shows no organisms.

A 10 F sound was passed through the stricture, which was about the largest that could be introduced without using force.

The size of the dose in the hands of other observers has been usually 10 to 20 ccm, although as much as 40 ccm at a dose has been given. The total amount varies between 30 to 100 ccm, usually between 40 to 60 ccm. The initial dose has usually been 10 ccm, less frequently 20 ccm. Since there exists the possibility of the production of anaphylaxis and because of the location of the infection in such important organs as the kidneys, I have made my initial dose very small and followed it with another comparatively small one. It was my intention in my first case to begin with a small dose and increase the size gradually until sufficiently large to bring about a marked reaction. In the first case this was reached at 15 ccm and in the second with 7 ccm and without any evidence of an acute pyelitis or an acute nephritis. The total amounts of my injections were 42 ccm in the first and 21 ccm in the second case.

The method of making the injection varies, many make it subcutaneously into the tissues about the involved joint. The small doses I give now subcutaneously, and the larger doses into the buttocks.

Héresco and Cealic state that the temperature rarely exceeds 100.4° to 101.4°. One of my cases, however, went to 103°, while the other reached only 101.5°, but it would seem that with larger doses I might obtain a more severe reaction and a higher temperature.

I would like (Case 1) to take this opportunity to direct your attention to the fact that the sacro-iliac joint is readily examined by

rectum in the majority of cases. The perianal swelling was readily made out in this case. I was able a year or two ago in a case of sacro-iliac dislocation to make a diagnosis of the condition by rectum after it had been overlooked in an X-ray examination.

An interesting point in Case 2 was the secondary infection with a gram negative diplococcus, which disappeared only after the performance of the meatotomy and the beginning of the dilatation of the stricture. It is already understood that such secondary infections occur and it has been pointed out that persisting after the gonorrhœal or-

ganisms disappear, they may be considered to have been the original and only infection, thus misleading us in our conclusions concerning the frequency of gonorrhœal ureteropyelitis. I was unfortunate enough to have the differentiation of the organism overlooked by the bacteriologist who made my cultures.

The gradual fall below normal in temperature in Case 2 after the second injection, which preceded the rise to 103°, and the long time between the injection and the beginning of the rise in temperature are interesting points which I am not prepared to explain to my entire satisfaction.

RECTOVESICAL AND ENTEROVESICAL FISTULÆ¹

By JOHN H. CUNNINGHAM, JR., M.D., F.A.C.S., BOSTON, MASSACHUSETTS

RECTOVESICAL and enterovesical fistulæ are uncommon conditions, and it is possibly on this account that so little is known concerning them. It is the purpose of this paper to consider briefly the different phases of the subject and to record cases which have come under my care, together with the deductions to be drawn from the cases recorded in medical literature.

The presence of fecal matter in the urine is of quite as much interest to the urologist as to the proctologist, yet the subject thus far has mostly been considered in the literature of the latter's specialty. That the condition is rare is evident from the fact that Pascal, in an excellent thesis which considered the literature of the subject up to the year 1900, could find but 286 cases of this affection, and Pristavescu, who searched the literature from this date to 1912, could add but 42 cases. Since that date I have been able to find but 8 additional cases, making a total of 342, including my own series of 6 patients. Of this series, about 75 per cent of these cases were females and 25 per cent males.

From the *pathological standpoint*, when air and fecal matter escape with the passage of urine there can be no doubt that a communication exists somewhere between the

bladder and some portion of the intestinal canal, and etiologically the lesions most frequently giving rise to the condition result from intestinal diseases, such as malignant growths and tuberculosis, rectal ulcerations, perirectal abscesses, diverticulitis, appendix abscesses, and rarely actinomycosis and syphilis. The lesions resulting in fistulæ are less often in the bladder, and when the primary cause of the perforation is here located it is usually the result of malignant growths, vesical tuberculosis, or trauma. I have observed one case of tuberculosis of the seminal vesicle resulting in an abscess which perforated into both the rectum and the bladder, and I have also observed one case in which a prostatic abscess resulted in the establishment of a vesico-rectal communication, but in most instances when a prostatic abscess ruptures into the intestinal and urinary tracts the rupture takes place into the urethra, whereby a recto-urethral fistulæ is established. Cripps mentions two cases in which stone in the bladder may have been the cause of the fistulæ. Pelvic abscesses originating from perforation of the rectovesical septum, and traumatic causes such as gunshot and stab wounds, fractures of the pelvis, and the now obsolete method of tapping the distended

¹Read before the American Urological Association, Baltimore, April 13, 1913.

bladder through the rectum, have been recorded as etiological factors Earle mentions a case where a rectovesical fistula was caused by injury to the bladder and rectum in performing a vaginal hysterectomy. Of the causes producing the fistula a variety of acute inflammations, carcinoma, tuberculosis, and traumatism, are the most common, while actinomycosis and syphilis are rare.

The location of the opening in the intestinal canal is most common in the rectum, nearly half of the collected cases being in this structure. The next most common location is in the sigmoid, and next in frequency are the small intestine and caecum. The location of the opening in the bladder is most frequently situated in the region of the trigone, yet many cases have been observed to be on the posterior wall and a few on the summit of the bladder. The fistulous tract between the bladder and intestinal canal may be a direct communication or a long and tortuous sinus. When of the former type it is generally the result of carcinoma or tuberculosis, originating in either the bladder or the rectum, in the latter it is more frequently the result of an abscess originating between the bladder and rectum and opening into these organs by apertures situated at different levels.

With the modern means of diagnosis the differentiation of vesicorectal and urethrorectal fistula is not as difficult as formerly, for aside from the fact that urethrorectal fistulae have their opening low down in the rectum (often within the reach of the finger) and rectovesical fistulae high up in the bowel, examination of the bladder with the cystoscope of the urethra with the urethroscope and of the rectum with the proctoscope and sigmoidoscope should establish the location of the opening without question. The location of the opening in the bladder by inspection is easier of accomplishment than is the opening in the rectum as the folds of mucous membrane may cover up the rectal opening and it may be necessary to inject the bladder with a colored fluid to observe its point of exit in the rectum through the proctoscope.

Symptomatically the presence of gas and fecal matter in the voided urine or the presence of urine in the rectum is pathognomonic,

and a careful inquiry into the history usually reveals symptoms referable to preexisting rectal or bladder affections prior to the perforation. After the perforation has occurred, the symptoms are generally aggravated, and frequent and painful urination dependent upon the resulting cystitis occurs. If the fecal matter which escapes into the bladder is in formed masses, tenesmus results. Later, secondary general symptoms occur and, if the suppurative process in the bladder is allowed to continue, renal infection with its train of symptoms takes place and may terminate the patient's life. The symptoms dependent upon the presence of urine in the rectum are those of a proctitis and are seldom of much consequence.

The *prognosis* must necessarily depend upon the nature of the primary lesion to which the fistula is secondary. It is naturally most unfavorable in cases in which carcinoma or tuberculosis is the primary cause. In instances in which the communication is due to an inflammatory or traumatic factor, the prognosis is far more favorable, for these cases are amenable to treatment either radical or palliative and in a small percentage a spontaneous cure has been effected.

Treatment This is best considered as operative radical and palliative, and non-operative. The form of treatment must depend largely upon the nature of the etiological factor producing the fistula. When the primary cause is traumatism or an inflammatory process such as simple ulceration, abscess, or rectal stricture operative measures offer much, but when the intestovesical communication is due to carcinoma or a tubercular process originating either in the bladder or alimentary canal, operative measures are less often followed by success. In instances where the fistula appears to have followed the rupture of an internal abscess or is due to tubercular ulcerations or syphilis, spontaneous healing under appropriate non-operative treatment has been known to take place.

The method of operative treatment must depend primarily upon the nature of the pathological process producing the fistula and a determination prior to operation of the

location of the opening within the gut. The possible operative methods at our command are —

1 Abdominal section, separation of the intestines from the bladder at the point of union, and repair of the opening in both organs, or if necessary a resection of the bladder and gut so as to include the fistulous tract, and repair of the incisions by the method most appropriate in the individual case. This operative procedure is suitable in traumatic and simple inflammatory processes and occasionally in certain cases where the communication is due to carcinoma or tuberculosis.

2 Perineal operations through the vagina or perineal surface in cases where the communication has been demonstrated to be low down in the rectum. Operations conducted from this region have seldom permitted of closing the rectal and vesical openings, but by separation of the adherent gut from the bladder, packing the wound, draining the bladder by a retained catheter, packing the rectum above the rectal opening and preventing the bowels from moving by a light diet and opium, has proved to be a successful method of dealing with this condition in some instances. This form of treatment, like the previous method, can only be expected to be followed by success when the primary cause of the fistula is traumatic or the result of the rupture of an internal abscess or simple ulceration, and is not to be undertaken when the primary cause is carcinoma or tuberculosis.

3 Colotomy, with the object in view of diverting the flow of feces from the bladder. The important point to be determined before performing colotomy is the location of the intestinal opening, for obviously if the communication is in the small intestine or cæcum, colotomy would be of no value. By so diverting the feces from the bladder, spontaneous closure of the communication has been observed, yet this palliative procedure should be reserved for cases where the communication is the result of carcinoma or tuberculosis.

4 Suprapubic cystotomy, with the end in view of allowing free drainage for the fecal contents of the bladder. This palliative

measure, which has been seldom employed, should be reserved for extensive carcinomatous growths of the bladder where little else can be done for the relief of suffering. The fistulous opening has never been successfully closed by the suprapubic route.

Non-operative treatment consists solely in the employment of certain measures which tend to make the patient's condition more tolerable. These non-operative palliative measures may be employed with benefit in the early period following the establishment of the communication in benign cases, but are of more service in the cases in which the fistula is due to tuberculosis or carcinoma, where for whatever reason the enumerated forms of operative treatment are inadvisable. In cases where non-operative methods must be employed for whatever reason, the diet should be of such character as to leave the smallest possible residue and yet supply the proper amount of nutrition. As a rule an effort should be made to keep the bowels confined for several days and then to empty them by the administration of such drugs as are conducive to a loose bowel movement, together with rectal injections. Daily or more frequent washing out of the bladder is of much value in relieving the vesical symptoms when the condition is tubercular, and the addition of strict hygienic measures, urinary antiseptics, and tuberculin should be employed.

In my series of six cases, three were due to the rupture of internal abscess, two were females, and the primary cause was disease of the pelvic generative organs. In the male of this class the primary cause was a prostatic abscess, and in this case no operative measures were undertaken. This patient is a physician and during the past ten years has had periods in which the communication has been alternately opened and closed. A cystitis has been constantly present in some degree, though not causing distressing symptoms, and he has remained in excellent general condition. In one of the females the communication was attacked through the vault of the vagina and the opening was permanently closed. The other female was operated upon through the abdomen while in a dan-

gerously ill condition. An enormous pelvic abscess containing at least two quarts of pus was evacuated. A communication between some portion of the bowel and the bladder took place six days following the operation, but by constant bladder drainage and irrigation through the abdominal wound the communication healed in three weeks.

I have observed one case, a male, in whom the communication between the bladder and rectum was tubercular. By strict attention to diet, hygienic measures, and bladder irrigations, the communication healed and remained so for years, the patient died of a general tubercular process. In two cases the primary cause of the fistula was carcinoma—one a male and one a female. In the male the growth was unquestionably primary in the bladder, and a suprapubic cystotomy was performed simply to relieve suffering. The symptoms were considerably relieved, but the patient, who was in very bad condition at the time of operation, died thirty-two days following the operation. The remaining case of this class had an adenocarcinoma primary in the sigmoid and multiple fibroids of the uterus. An abdominal section was made—a hysterectomy had to be performed before the fistula could be dealt with. About one-fourth of the bladder and five inches of the sigmoid was resected. The bladder wound was closed by suture, and the cut ends of sigmoid were united by an end-to-end anastomosis. An uneventful recovery followed. The details of these cases are here appended.

It may occur to many that such operations in the field of the proctologist, the gynecologist, and the abdominal surgeon as were necessary to the successful operative treatment of the cases here mentioned may hardly be considered to be within the genito-urinary surgeon's province, yet no one can dispute the fact that the diagnosis of the condition of feces in the urine must necessarily command his attention, and in my opinion this condition belongs properly to the genito-urinary surgeon, who should be equipped with the skill necessary to relieve the condition.

CASE 1. *Fistula due to a pelvic abscess.* Woman, age 26, Long Island Hospital, September 22,

1904. There was a past history of gonorrhœa four years ago and again eight months ago. Since the latter infection there has been much pain in the lower back, especially in the right side—most marked at the time of menstruation, and a moderate amount of constant vaginal discharge. During the past six months there has been frequency in urination which has gradually increased and during the past week has been every half hour during the day and night. The temperature has been of a septic character, rising and falling between 100° and 102° with severe pelvic pain. A vaginal examination showed a pelvic mass filling the posterior vault of the vagina, which was extremely tender, and there was tenderness and spasm with some rigidity of the muscles in the lower part of the abdomen. The urine showed a large amount of pus and was in other ways the urine of a severe cystitis.

A vaginal section evacuated several ounces of thick pus. The temperature fell following the operation and the patient's general condition gradually improved. Two days following the operation feces and gas were passed by the urethra and from the incision in the vaginal vault. The patient's general condition continued to improve, however, and two weeks following the operation the patient was again etherized and a cystoscopic examination demonstrated the opening into the bladder to be about two inches above the right ureteral orifice slightly to the outer side of perpendicular line. The hole in the rectum could not be seen with the proctoscope, but a methylene blue solution injected into the bladder while the proctoscope was still in the rectum was seen to enter the rectum at a distance of about six inches from the anus. The opening of the rectum was on the anterior surface. The methylene blue solution also escaped through the vaginal incision, which had contracted so that it would admit only a large-size probe. The vaginal sinus was opened by blunt dissection without opening the peritoneal cavity, and through it a probe could be passed in one direction into the rectum and in another into the bladder. The cavity was swabbed out with crude carbolic acid followed by alcohol and the cavity packed with iodoform gauze. The anus was dilated, and through a rectal speculum the rectum was wiped with sponges wet with hydrogen peroxide, a rubber tube eight inches long and covered with iodoform gauze was placed in the rectum so as to cover the rectal opening. A self-retaining catheter was placed in the bladder. The patient made a good operative recovery. She was kept on a liquid diet and the bowels were confined by a pill opus night and morning. The vaginal packing was not removed for three days, then a smaller iodoform packing was replaced and changed daily for five days. After this no further packing was placed in the vaginal wound, which was much diminished in size and with but little discharge. The rectal tube was removed on the tenth day, but the catheter was left in the bladder and irrigation three times a day, of two ounces of potassium per-

manganate, which had been instituted two days after operation, was continued. Vaginal douches were begun after the packing in the vagina was discontinued. The bowels were moved on the twelfth day by catharsis and an oil enema, although there had been some escape of feces through the anus previous to this time. There was no escape of fecal matter from the vagina. The bladder drainage was discontinued on the sixteenth day, at which time the vaginal wound had closed, following the emptying of the bowels, the bowels were again prevented from moving by large doses of opium. The urine following the discontinuation of the bladder drainage still showed a cystitis of moderate severity. The communication between the bladder and rectum never reestablished itself. The patient left the hospital three months after the operation, with no symptoms except a backache which was probably dependent upon the pelvic adhesions. These she refused to have remedied by further surgical interferences.

CASE 2 *Fistula due to internal abscess* Woman, age 34, seen in consultation with Dr. Douglass Lithgow, April 10, 1910. The past history reveals the fact that six years ago the patient had a swelling in the right lower portion of the abdomen which was diagnosed as fibroid of the uterus. She refused an operation at that time, but had daily massage of the mass with ointments for two months, at the end of which time the mass had entirely disappeared and she remained well until the present illness. Menstruation has always been regular, of four days' duration, and occurring every seventeen days.

Sixteen days ago the patient became drenched in attempting to shut off the water escaping from a burst water pipe. The day following she had severe pain in the lower abdomen and the next day a severe chill. Three days after she called Dr. Lithgow, who found her temperature 102° and the pulse 103. The abdomen was tender everywhere, with spasms. I then saw the patient. The general appearance was that of sepsis. A vaginal examination showed the cervix close to the pelvic bone, the posterior cul de sac bulging and very tender. An indefinite tumor mass, round in outline and extending to the umbilicus, could be felt. Its exact character could not be determined because of the tenderness and rigidity of the abdominal muscles. The patient refused operation and for two days the local signs changed but little, but she failed rapidly.

Operation Trendelenburg position. Median incision showed a tumor about the size of one's head. Omentum and intestines were much adherent to the mass. In separating them a cyst the size of a grapefruit was ruptured, with the escape of clear fluid (probably an ovarian cyst). In freeing the omentum from the mass a large abscess was opened and some of the pus escaped into the abdominal cavity. This was swabbed out and the abdominal cavity packed off with large strips. The ab-

sciss sac was found to be behind the uterus, adherent to it and to coils of intestines in the pelvis. Two smaller abscesses the size of oranges opened into the larger ones. The intestines bulged into the sac with sac wall covering them. The sac was sewed to the abdominal wall at the lower end of the incision. It was swabbed out with alcohol and packed with gauze. Two strips were placed, one in each flank above the sac. The wound was partially closed by deep catgut and superficial silkworm sutures. The patient was kept in Fowler's position for five days.

Much to our surprise, the patient gained rapidly following the operation, but on the seventh day feces and gas were passed with the urine, and feces appeared in the abdominal wound. A large De Pezzer catheter was placed in the bladder and bladder irrigation was carried out every four hours. The abdominal wound was irrigated every four hours also. The patient continued to gain in general condition. The fecal fistula closed twenty days later and at the same time the feces and gas disappeared from the urine, although a cystitis remained for about two months. The abdominal wound was entirely healed thirty six days following the operation. The patient has remained in excellent health and at present has no urinary or intestinal symptoms and the menstrual periods occur as previous to operation. There is a small abdominal hernia at the bottom of the wound scar.

CASE 3 *Fistula due to a prostatic abscess* Male, age 39, a physician, had gonorrhea at the age of twenty, lasting six months without treatment or complications. Another attack at twenty-four, lasting four months without regular treatment. Some weeks after onset patient sat down hard and felt something break in the rectum, and considerable thin cloudy fluid came from the penis, and two days later after coitus active bleeding took place from the urethra, about six ounces of blood was lost, but there were no other symptoms. At the age of twenty-nine he had another attack of gonorrhea which was not treated. About four months after the onset, and while the discharge was still active, the patient drank a large amount of champagne. Two days later symptoms of acute infection of the prostate were experienced. These increased for about a week and were accompanied by marked prostration and increased frequency and difficulty in urination. About two weeks later the abscess broke into the rectum and into the bladder. Aside from the presence of pus, gas and feces in the bladder and urine in the rectum the patient's condition was more satisfactory. The pain and difficulty in urination were much relieved with the establishment of the fistula. The communication remained open, so that there was a free communication for over a year. The fistula gradually diminished in size, so that little fecal matter came into the bladder and much of the urine escaped into the rectum. Aside from taking urinary antiseptics the patient had no treatment. Four years after the establish-



Fig 1 Shows point of anastomosis of sigmoid with the bladder

ment of the fistula the patient consulted me. At that time the urine was very cloudy from pus, alkaline, with one half of one per cent of albumin. There were no renal elements and the urine was that of a chronic cystitis. Frequency was four or five times a day and once at night. There was no pain and about half of the urine was passed from the penis and half from the rectum. The patient's general condition was excellent. The physical examination showed the external genitals to be normal except for the moderate varicocele on the left. Rectal examination showed the prostate to be small and atrophied. The left vesicle was normal, but just below the right vesicle there was an indurated area which ran as a hard shelf of tissue about a centimeter wide downward and inward toward the median line. The communication in the rectum was located in this indurated area.

A cystoscopic examination revealed no residual urine, but the instrument during its introduction met three distinct jumps in the prostatic urethra. Bladder capacity eight ounces. Just below the right urethral orifice on the trigone there was an ulcerated area about the size of a ten cent piece with fibrin adherent to its surface. The remaining portions of the bladder showed a chronic cystitis.

For about one month the patient was given daily irrigation of the bladder and the urethra dilated to twenty eight Fr. with some improvement in the cystitis.

At the present time, ten years after the establish-

ment of the fistula, a few drops of urine still escape from the bladder into the rectum. A cystitis has existed at all times in varying degree, without causing symptoms other than some frequency and tenesmus at times, but at no time has there been any discomfort or irritation of the rectum since the breaking of the abscess. This patient is in excellent general health.

CASE 4. *Fistula due to tuberculosis.* Male age 45, seen with Dr. Thorndike, for cystoscopic examination. I am indebted to him for the following history. The patient was tubercular from early childhood. In 1893 Dr. Edward Bradford did a laminectomy for Pott's disease. A few years later the patient developed a tubercular epididymis, for which Dr. Thorndike did a castration, a few years subsequently he removed the other testicle for the same disease. In 1902 the patient developed symptoms of a tubercular cystitis and in the summer of 1903 gas and fecal matter appeared in the urine, and the bowel movements were watery from the presence of urine in the rectum. Regular irrigations of the bladder resulted in the apparent closure of the communication, and on October 1, 1903 I cystoscoped the patient and observed the condition to be as follows:

Cystoscopy under ether. Six ounces of distended medium. Trigone distinct with some hypertrophy of the bladder wall and increased injection of the mucous membrane everywhere. Left urethral orifice was normal in size and function. The

manganate, which had been instituted two days after operation, was continued. Vaginal douches were begun after the packing in the vagina was discontinued. The bowels were moved on the twelfth day by catharsis and an oil enema, although there had been some escape of feces through the anus previous to this time. There was no escape of fecal matter from the vagina. The bladder drainage was discontinued on the sixteenth day, at which time the vaginal wound had closed, following the emptying of the bowels, the bowels were again prevented from moving by large doses of opium. The urine following the discontinuation of the bladder drainage still showed a cystitis of moderate severity. The communication between the bladder and rectum never reestablished itself. The patient left the hospital three months after the operation, with no symptoms except a backache which was probably dependent upon the pelvic adhesions. These she refused to have remedied by further surgical interferences.

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dominal sac was found to be behind the uterus, adherent to it and to coils of intestines in the pelvis. Two smaller abscesses the size of oranges opened into the larger ones. The intestines bulged into the sac with sac wall covering them. The sac was sewed to the abdominal wall at the lower end of the incision. It was swabbed out with alcohol and packed with gauze. Two strips were placed, one in each flank above the sac. The wound was partially closed by deep catgut and superficial silkworm sutures. The patient was kept in Fowler's position for five days.

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CASE 3 *Fistula due to a prostatic abscess* Male, age 30, a physician, had gonorrhea at the age of twenty, lasting six months without treatment or complications. Another attack at twenty-four lasting four months without regular treatment. Some weeks after onset patient sat down hard and felt something break in the rectum, and considerable thin cloudy fluid came from the penis, and two days later after coitus, active bleeding took place from the urethra, about six ounces of blood was lost, but there were no other symptoms. At the age of twenty-nine he had another attack of gonorrhea which was not treated. About four months after the onset, and while the discharge was still active, the patient drank a large amount of champagne. Two days later, symptoms of acute infection of the prostate were experienced. These increased for about a week and were accompanied by marked prostration and increased frequency and difficulty in urination. About two weeks later the abscess broke into the rectum and into the bladder. Aside from the presence of pus, gas and feces in the bladder and urine in the rectum the patient's condition was more satisfactory. The pain and difficulty in urination were much relieved with the establishment of the fistula. The communication remained open so that there was a free communication for over a year. The fistula gradually diminished in size so that little fecal matter came into the bladder and much of the urine escaped into the rectum. Aside from taking urinary antiseptics the patient had no treatment. Four years after the establish-

could be palpated through the abdominal wall. This was more clearly felt in a bimanual examination. The proctoscope passed for a distance of sixteen inches failed to reveal the opening into the rectum.

A cystoscopic examination showed the communication within the bladder to be located about two inches above and slightly to the left of the left urethral orifice. The area about the fistula was irregular, slightly elevated, indurated, and about the size of a twenty five cent piece. It looked not unlike a sessile carcinoma. The remaining portion of the bladder showed acute cystitis. A solution of methylene blue was injected into the bladder and was found to escape into the rectum, but at a point above the end of the proctoscope.

Operation, Hart Hospital, February 19. Patient in Trendelenburg position. Median incision beginning over the pubis and extending upward four inches. The sigmoid was observed winding around the left side of the fibroid mass and attached to the posterior surface of the bladder about two inches to the left of the median line. The omentum was adherent to the posterior surface of the bladder and fibroid uterus. This was freed and a hysterectomy was performed. The uterus contained multiple fibroids and was irregularly the size of an average grapefruit. The intestino-vesical union could then be more carefully examined. It was found that there was an indurated area chiefly on the intestinal side of the junction. This indurated area formed a mass involving about one half the circumference of the sigmoid, which was slightly dilated and continuous as a ring shaped mass in the bladder wall, the bladder infiltration being of a lesser extent than in the intestinal wall.

A clamp was placed on the bladder so as to include the wall two centimeters beyond the indurated area, and this portion of the bladder was cut away, thus freeing the sigmoid with the resected portion of the bladder attached. The cut bladder walls were sutured with the clamp still in position by a running catgut suture. The clamp was then removed and another running catgut suture placed so as to enfold the cut edges. The sigmoid could then be freely drawn out of the wound. Clamps were placed two inches beyond either side of the indurated area and this portion of the sigmoid was removed together with a V shaped piece of the mesentery. An end to end anastomosis was done. No nodes could be palpated in the mesentery, liver, or pelvis. A drain was placed to the anastomotic area through a stab wound. The abdominal wound was closed and a self retaining catheter placed in the bladder. Pathological examination of the specimen showed adenocarcinoma of the sigmoid and bladder primary in the sigmoid.

The patient made an uneventful recovery, except that there was a slight infection in the upper part of the wound. The abdominal drainage was removed on the third day and since then the bowels have moved voluntarily or by medication daily.



Fig 3 Shows the disease in the bladder and intestine about the sinuses

The patient left the hospital in twenty days in excellent condition. At the present time a slight cystitis persists.

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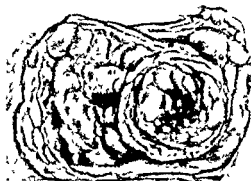


Fig. 2 Shows disease in bladder and intestine about the anus

right urethral orifice was normal in shape and directly below it, on the trigone, was a pearl-colored shallow ulcer with deep red, clean-cut, and slightly indurated edges about 1 by 1.5 cm in size. This area corresponded to the region of the lower part of the right seminal vesicle, which by rectal examination was found to be much enlarged and tubercular in character. The prostate was everywhere covered with nodules the size of small peas. Rectal examination showed a small indurated area in the median line just inside of the indurated right tubercular vesicle which was continuous with the right lobe of the prostate. The prostate was nodular in character and unquestionably tubercular.

The fistula never reestablished itself. The patient died in the winter of 1914 from the results of a general tuberculosis.

CASE 5. *Fistula due to carcinoma primary in the bladder.* Male referred by the late Dr. John Flint September 6, 1905, with the history that he had always enjoyed good health until the past two months, during which time he has had periods of hematuria lasting from one to three days, sometimes painless and at other times painful, especially when clots were passed. There has been a slight frequency in urination for the past six months at times especially when the bowels were constipated, he experienced a heavy dull ache in the perineum, down the backs of the legs and in the rectum. The constipated movements during the past month have often been covered with blood-streaked mucus and the patient has recently developed hemorrhoids.

Five days ago the patient after a constipated movement of the bowels, had considerable pain in the perineum and shortly after there was an imperative desire to urinate. Gas escaped with a small amount of urine. The desire to urinate persisted and, by constantly straining, some fresh blood and a mass of fecal matter the circumference of a pencil and about two inches long was passed by the urethra. A doctor was called and morphine was administered, also a physic was given and the

following day the severe symptoms had subsided somewhat, but frequent and painful urination persisted and the urine continued to contain gas, feces, and blood in large amounts. Blood was also present in the bowel movements. When seen by me, the patient was comfortable except for the frequent urination. He was cachectic in general appearance and weighed one hundred and thirty pounds. Rectal examination with the finger failed to detect the fistulous opening, but the proctoscope located it as an indurated, rough-edged, bleeding area on the left anterior surface of the rectum at a distance of six inches from the anus. A cystoscopic examination was not very satisfactory, as the distending medium escaped rapidly into the rectum. Enough was seen, however, to establish the fact that the growth was extensive.

Faecal matter continued to be emptied into the bladder, and the tenesmus was so severe that the patient began to lose rapidly in general condition. A suprapubic cystostomy was therefore performed under ether anesthesia. The carcinomatous mass occupied most of the posterior surface of the bladder and fecal matter was everywhere adherent to it. The opening into the rectum was found to be on the posterior wall to the left of the median line. A large part of the growth was scooped out with the hand and the remainder burned with the actual cautery to control the hemorrhage. The bladder was packed with iodoform gauze and a long rectal plug was placed in the rectum. The following day the rectal and bladder packing had to be removed on account of pain. The patient lived thirty-two days following the operation. He was quite comfortable. Excess escaped from the wound, but by frequent irrigation he was kept clean and without the distress which was intolerable prior to operation.

About a week before the end the patient became stupid, slept most of the time and took nourishment reluctantly. The pulse became weaker and the temperature subnormal. The urine was unquestionably much diminished and twenty-four hours prior to death there was extreme, if not entire, suppression of the urine.

CASE 6. *Fistula dependent upon adenocarcinoma of the sigmoid.* Maiden lady age 39 referred by Dr. David Eldridge February 7, 1915. The patient had always enjoyed excellent health except for occasional periods of constipation. February 3, 1915 she became unwell and the day following noticed that she passed gas from her bladder during micturition. The day following the patient passed gas and some formed fecal matter mixed with the urine. Dr. Eldridge was called and found that the patient's urine contained fecal matter, considerable blood and some pus. She was given a laxative, which increased the amount of fecal matter in the urine. On February 13 ten days after the onset, I made an ether examination.

The patient was small but fairly nourished. An irregular fibroid of uterus of considerable size

DEPARTMENT OF TECHNIQUE

DUODENO-JEJUNOSTOMY WITH EXCLUSION OF UPPERMOST JEJUNAL LOOP FOR ANGIOMA OF THE DUODENO-JEJUNAL JUNCTION AND UPPER JEJUNUM

BY EDWIN BEER, M.D., F.A.C.S., NEW YORK

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THE following case is placed on record not only because of the rarity of the condition, but also because of the unusual operation performed.

In a review of the literature of these cavernous tumors, a number of cases are found in which the patients had bled to death. Most of these tumors, as far as one can judge from the description, have been small and limited to the inner wall of the intestine.

According to Nothnagel, of all benign growths angiomas lead to the most severe bleeding. According to H. Benneke,¹ the literature contains reports of twenty cases of these tumors found in children and adults. He states that they were found in all parts of the alimentary tract and are frequently multiple. In a number of cases, a fatal bleeding led to the death of the patients.

In McCallum's² article, the author refers to another type of hæmangioma or angioma, in which the small tumors are multiple and scattered throughout the intestine. In the case that he himself reports, he counted as many as forty such small tumors measuring 7 to 8 mm. in diameter.

The history and operation in the case here reported is as follows:

Female, 19 years old, admitted to Mount Sinai Hospital, July 8, 1914. Chief complaints: Pallor, weakness, blood in stools. Past history: Patient has had numerous attacks of tonsillitis. Has never menstruated. For the past five years there has been gradual increase in pallor and weakness, with many attacks of faintness. There was frequent epistaxis. A year ago the fainting spells were accompanied by nausea, and patient vomited incessantly regardless of meals. Her condition became so bad that she went to the hospital where she had several hemorrhages from the bowels. In July, 1913, patient had been in the hospital where she was treated for anemia. At that time her blood picture was that of anemia. She left the hospital August 23, 1913, and felt well till eight weeks before the present admission when she began to feel

weak and vomited both solid and fluid food. Shortly before admission she again passed blood in her stools in large amounts, and on several occasions vomited blood.

Physical examination, July, 1914. A small sized, but well developed young girl who presented all the signs of a severe secondary anemia. All attempts to discover the cause of this anemia failed. There were no ova found in the stools, sigmoidoscopy was negative. Test meal was practically normal, so was her urine. Owing to the continued loss of blood, the patient's hæmoglobin fell till it reached 17 per cent. She was then transfused and transferred from the medical side of the hospital (service of Dr. Libman) to the surgical side (service of Dr. Beer). No positive diagnosis of the source of the blood had been made. The patient had passed blood by the rectum as well as per os.

The differential diagnosis rested between (1) a silent bleeding duodenal ulcer, (2) a tumor of the stomach or intestine (vascular), and (3) the possibility of a portal obstruction. Against the ulcer diagnosis we had to weigh the absence of all gastric symptoms and the absence of all dyspepsia. Against the portal obstruction stood the fact that there was no evidence in the abdominal wall or about the rectum of such obstruction, so that by exclusion we were forced to think the condition was most likely due to a vascular tumor, i.e., polyp or papilloma.

September 23, 1914, the following operation was performed:

Exploratory laparotomy for gastro-intestinal hemorrhages. Duodeno-jejunostomy and exclusion of duodeno-jejunal junction and upper foot of jejunum for angioma (racemose) of upper jejunum (Dr. Beer). Through a four to five inch upper right rectus incision the upper abdomen was explored. There was no sign of undue congestion in the portal system and there were no glands at the portal fissure. The liver, right kidney, stomach, duodenum, and head of the pancreas as well as the right half of the colon, were absolutely normal. The colon was turned up to expose the small intestines, which were spastically contracted and negative up to within six inches of the fosa of Treitz where the jejunum suddenly became red in color due to the injection of a large number of minute vessels. After separating adhesions which bound this diseased part of the jejunum to the transverse mesocolon it was seen that the whole surface of the upper three to four inches of the jejunum was covered with dilated vessels,

¹Archiv u. Archiv f. path. Anat. etc. Berlin vol. clxxxv.

²Johns Hopkins Bulletin 1906.

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DEPARTMENT OF TECHNIQUE

DUODENO-JEJUNOSTOMY WITH EXCLUSION OF UPPERMOST JEJUNAL LOOP FOR ANGIOMA OF THE DUODENO-JEJUNAL JUNCTION AND UPPER JEJUNUM

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THE following case is placed on record not only because of the rarity of the condition, but also because of the unusual operation performed.

In a review of the literature of these cavernous tumors, a number of cases are found in which the patients had bled to death. Most of these tumors, as far as one can judge from the description, have been small and limited to the inner wall of the intestine.

According to Nothnagel, of all benign growths angiomas lead to the most severe bleeding. According to H. Benneke,¹ the literature contains reports of twenty cases of these tumors found in children and adults. He states that they were found in all parts of the alimentary tract and are frequently multiple. In a number of cases, a fatal bleeding led to the death of the patients.

In McCallum's² article, the author refers to another type of hæmangioma or angioma, in which the small tumors are multiple and scattered throughout the intestine. In the case that he himself reports, he counted as many as forty such small tumors measuring 7 to 8 mm. in diameter.

The history and operation in the case here reported is as follows:

Female, 19 years old, admitted to Mount Sinai Hospital, July 8, 1914. Chief complaints: Pallor, weakness, blood in stools. Past history: Patient has had numerous attacks of tonsillitis. Has never menstruated. For the past five years there has been gradual increase in pallor and weakness, with many attacks of faintness. There was frequent epistaxis. A year ago the fainting spells were accompanied by nausea and patient vomited incessantly regardless of meals. Her condition became so bad that she went to the hospital where she had several hemorrhages from the bowels. In July, 1913, patient had been in the hospital where she was treated for anemia. At that time her blood picture was that of anemia. She left the hospital August 23, 1913, and felt well till eight weeks before the present admission, when she began to feel

weak and vomited both solid and fluid food. Shortly before admission she again passed blood in her stools in large amounts, and on several occasions vomited blood.

Physical examination, July, 1914. A small sized, but well developed young girl who presented all the signs of a severe secondary anemia. All attempts to discover the cause of this anemia failed. There were no ova found in the stools, sigmoidoscopy was negative. Test meal was practically normal so was her urine. Owing to the continued loss of blood, the patient's hemoglobin fell till it reached 17 per cent. She was then transfused and transferred from the medical side of the hospital (service of Dr. Libman) to the surgical side (service of Dr. Beer). No positive diagnosis of the source of the blood had been made. The patient had passed blood by the rectum, as well as per os.

The differential diagnosis rested between (1) a silent bleeding duodenal ulcer, (2) a tumor of the stomach or intestine (vascular), and (3) the possibility of a portal obstruction. Against the ulcer diagnosis we had to weigh the absence of all gastric symptoms and the absence of all dyspepsia. Against the portal obstruction stood the fact that there was no evidence in the abdominal wall or about the rectum of such obstruction, so that by exclusion we were forced to think the condition was most likely due to a vascular tumor, i.e., polyp or papilloma.

September 23, 1914, the following operation was performed:

Exploratory laparotomy for gastro-intestinal hemorrhages. Duodeno-jejunostomy and exclusion of duodeno-jejunal junction and upper foot of jejunum for angioma (racemose) of upper jejunum (Dr. Beer). Through a four to five inch upper right rectus incision the upper abdomen was explored. There was no sign of undue congestion in the portal system and there were no glands at the portal fissure. The liver, right kidney, stomach, duodenum and head of the pancreas as well as the right half of the colon were absolutely normal. The colon was turned up to expose the small intestines, which were spastically contracted and negative up to within six inches of the fossa of Treitz, where the jejunum suddenly became red in color due to the injection of a large number of minute vessels. After separating adhesions which bound this diseased part of the jejunum to the transvers. mesocolon it was seen that the whole surface of the upper three to four inches of the jejunum was covered with dilated vessels,

¹ Varchow's Archiv. f. path. Anat. etc. Lief. 1. vol. cxxxiv.

² Johns Hopkins Bulletin, 1900.



Fig 1 Shows incision in posterior parietal peritoneum held open exposing duodenum its stoma, and excluding ligature To the other side of the mesocolon is the vascular tumor, looking like an enormous conglomerate of vessels involving the upper three to four inches of jejunum

many of which were fully one eighth to one tenth inch in diameter and projected over the level of the adjacent jejunal wall (Fig 1) As this vascular tumor extended up to the duodeno-jejunal junction, a resection was impossible An attempt to tie off the more prominent vessels did not seem practicable, and after passing one silk ligature about one of the largest vessels no further attempt was made It was therefore determined to expose the third portion of the duodenum retroperitoneally and exclude the duodeno-jejunal junction and adjacent tumor bearing area, and then do a duodeno-jejunal anastomosis

The peritoneum over the third part of the duodenum was cut through and a circular exclusion silk ligature was passed about it after pushing the pancreas out of the way The furrow made by tying this ligature (loosely) was buried by two layers of sutures, the second layer bringing the cut posterior parietal peritoneum into approximation with the first layer of sutures, then a typical clamp suture anastomosis between the mobilized second part of the duodenum down to the bend into the third part and a part of the jejunum about one foot from the duodeno-jejunal junction was made in an isoperistaltic direction In making this anastomosis, every advantage was taken of using the jejunal serosa to cement the union, as the duodenum had no peritoneal covering

While these operative procedures were going on it was evident that the tumor was bleeding as the gut filled up under our eyes and became distended with soft clots.

Wound closed in layers small rubber dam drain being left in center of wound down to the duodenum

After the operation the patient vomited several ounces at a time, and repeatedly She also complained of cramps in the epigastrium Obstructive symptoms disappeared as soon as the rubber-dam drainage was removed By the fifteenth day she was walking on the roof, feeling very well On the sixteenth day there was a sudden change, the patient becoming weak again, blood appearing by rectum, and within the next twenty four hours, one massive hemorrhage having followed another, the patient died

Epicrisis It is evident from this experience that an effective anastomosis between the retroperitoneal duodenum and jejunum can be made by suture, and with the conditions presented by this case it is apparent that such an anastomosis, combined with an exclusion of the uppermost jejunal loop, was the only procedure that promised any result,

A SIMPLE AND SATISFACTORY CLOSED ETHER APPARATUS

By L. G. BOWERS, M.D., F.A.C.S., DAYTON, OHIO, AND L. F. ROSS, M.D., RICHMOND, INDIANA

THE separate parts of the apparatus are shown in Fig. 1 and consist of the rubber bell of the so-called "plumbers' friend" (a), a No. 3 soft rubber English ice-bag (b), and one piece of an ordinary nickel plated brass trap such as is used in lavatories (d). The rubber bell is easily cut with a safety-razor blade held in a haemostat, to fit over the nose (Fig. 2, e). For many faces a curve must be cut opposite the nose notch to fit over the chin (Fig. 2, f). The bell is easily cut down to fit a child's face, as shown in Fig. 2, e. The short arm of the trap ends in a flange over which the neck of the ice-bag is slipped and held in place by a rubber band. Several inches of the long arm of the trap should be sawed off, as they come longer than is convenient for use. This plain end is slipped into the socket intended for the handle of the "plumbers' friend" after the disc separating the socket from the lower cone-shaped portion has been cut out. The one and one-fourth inch trap and the rubber bell can be had at a plumbing shop and the ice-bag at a drug-store. In case a proper sized trap is not available, a piece of iron pipe fitted with a return bend, as shown in Fig. 1, c, will answer the purpose. Rubber bells with a smooth inside surface are preferable to those reinforced by projecting ridges on the inside.

Two methods of admitting air to the apparatus have been used. Two small holes may be punched in the rubber bell, as shown in Fig. 2, f. These are partly or completely covered by

the fingers of the anesthetist, to regulate the amount of air. The other method is to make a collar from a piece of brass tubing that will fit the pipe snugly just above the bell. Two holes are drilled through the collar and pipe, as shown in Fig. 2, e, so that by rotating the collar the openings are partly or completely closed, just as the air is regulated in an ordinary Bunsen burner. This method is much more convenient.

The bell must fit the face closely enough to exclude the air in order to manage the anaesthesia properly, and it is therefore desirable to have on hand several bells with different sizes and shapes of nose openings in order to fit the face accurately. An extra uncut bell should be on hand so that it may be cut to fit the patient in case none already cut fits properly.

In use, six ounces of ether is poured into the bag through the bell, and the apparatus is gradually lowered and carefully adjusted to the patient's face to exclude all air. The air holes are left open, the first two or three minutes, and then gradually closed and kept closed unless the patient becomes slightly cyanotic, in which event they are opened until proper color returns to the face. A very important point to be observed is that the mask must not be removed at all or very rarely to

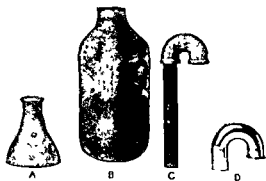


Fig. 1. a, rubber bell; b, ice bag; c, iron pipe fitted with a return bend; d, nickel plated brass trap.

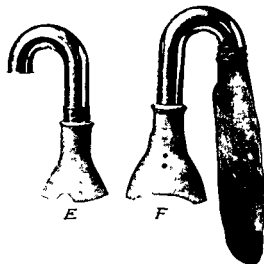


Fig. 2. e, Rubber bell; f, showing curve cut in rubber bell.

wipe the patient's mouth, etc., for so much air is thus admitted that perfect anesthesia cannot be maintained. Failure to observe this caution in the beginning may make it difficult or impossible to secure complete anesthesia.

The advantages of the method are —

1. The very small amount of ether used — an average abdominal operation requiring four ounces or less. This greatly reduces the nausea and shock to the patient, and saves waste of ether.

2. Only warm ether vapor is given the patient after the first few minutes, as, by the time the patient is "under," the ether vapor has been warmed by the expired air. The warm vapor is much less likely to produce a pneumonia or

bronchitis than is the cold vapor of the open method.

3. The high concentration of ether vapor possible with the air vents closed enables one to take the patient rapidly through the excitement and vomiting stages, and complete surgical anesthesia is reached in a much shorter time than by the open method.

4. Advantage is taken of the stimulating effect of carbon dioxide on the respiratory center, but cyanosis is readily controlled by use of air vents.

5. The operating room is not filled with ether vapor as by the open method.

6. The apparatus is cheap, sterilizable, portable, and has no complicated parts to get out of order.

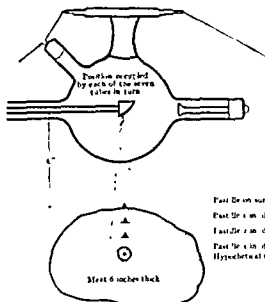
TECHNIQUE AND EXPERIMENTAL APPLICATION OF HARD RAYS FOR DEEP RÖNTGENTHERAPY

By ELWIS GREGORY COLE, M.D. NEW YORK

ABOUT a year ago I made some tests comparing the therapeutic efficiency of the Coolidge tube with the standard X ray tube, the results of which were published in the November *Review of Reviews*.¹ Recently I have

¹ *Med. Rev. of Revs.* 1915, Nov.

repeated these tests, particularly those referring to the quantity of the rays which penetrate three inches below the surface compared with those delivered at the surface. These recent tests check up so closely with the ones made a year ago that I shall refer to the diagrams illustrating my



Tube No.	Penetration at	Partial Spark (amp.)	Exposure in	M.M. average (in minutes)	Exposure
1	0	1	1	10	10
2	1	1	1	10	10
3	1	1	1	10	10
4	1	1	1	10	10
5	1	1	1	10	10
6	1	1	1	10	10
7	1	1	1	10	10

average 10 total 70
Average in 10 minutes 10

10 times an erythema dose applied to surface

Fast 10 in surface

4 times an erythema dose applied 1 in below surface

Fast 10 in deep

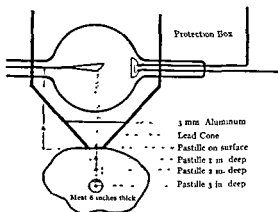
Two an erythema dose applied 2 in below surface

Fast 10 in deep

Hypothetical tumor

1 erythema dose applied to tumor

Diagram 1



Parallel Spark Gap	Milli amperage	Exposure (minutes)	Hampson Reading
8	10	1	Surface 4
8	10	1	Surface 6
8	10	1	Surface 12
8	10	1	Surface 16
8	0	1	Surface 20
8	10	1	(1 in deep) 15
			(2 in deep) 8
			(3 in deep) 4
Total 6			

6 times an erythema dose applied to surface

4 times an erythema dose 1 in deep

Twice an erythema dose 2 in deep

1 erythema dose 3 in deep

Diagram 2

previous communication to demonstrate the points as far as I went at that time

The advent of the Coolidge tube marked a new era in roentgentherapy. Rays were obtained from this tube that excelled others in penetration, and it could be operated continuously without any fluctuation at a penetration greater than that even temporarily obtained in the standard type of tube.

In order to demonstrate the superiority of the Coolidge tube over the standard type of tubes and to prove that with the Coolidge tube an amount of X-ray equivalent to an erythema dose may be administered to a tumor three inches below the surface without endangering the skin itself or intervening tissues, the following experiments¹ are submitted, showing—

- 1 That most of the rays from the ordinary tube, operated at its greatest penetration with a standard "transformer," are absorbed in the first inch of the tissue, if no filter be interposed.
- 2 That with the ordinary tube, operated to its fullest capacity on such an apparatus, no filter being interposed, eleven and one-half minutes are required to obtain an erythema dose three inches below the surface and that sixteen times an erythema dose is meanwhile administered to the skin.
- 3 That with the Coolidge tube a full erythema dose can be administered to the surface in thirty seconds, if no filter be interposed.
- 4 That with the Coolidge tube four Hampson units can be applied to the surface in one minute, through three millimeters of aluminum.
- 5 That with the Coolidge tube a dose of four Hampson units can be obtained three inches below the surface in six minutes through six ports of entry, using a three-millimeter filter.

¹ Pfahler advocated and described the use of a filter in 1906.

The experiments undertaken in proof of these tenets consisted of the roentgenization of an area three inches below the surface of a piece of meat six inches thick, a depth of tissue calling for a penetration about equal to that required for treating a cancer of the pylorus or cancer of the uterus. The surface of the meat was six inches from the focal point. The doses were measured by Hampson pastilles, one placed on the surface of the meat, a second imbedded one inch deep, a third located two inches from the surface, and a fourth three inches from the surface.

The first experiment, illustrated in Diagram 1, shows the inefficiency of the X ray treatment of deep lesions by the ordinary roentgen ray tubes, when neither filters nor the cross fire method is employed.

Experiment 1. The area three inches from the surface of the meat was exposed to rays from seven ordinary tubes, excited to their greatest capacity by a standard transformer with a parallel gap ranging from seven to four inches, this average being about four and a half to five inches parallel gap, according to the table given on the diagram. Eleven and one-half minutes were required to obtain a ray equal to an erythema dose at the fourth pastille, situated three inches below the surface, the supposed depth from the surface of a cancer of the pylorus. The surface pastille received coincidentally sixteen times an erythema dose—an exposure which of course would have burned a patient beyond recovery.

If not more than an erythema dose had been administered on the skin, only one sixteenth dose would have reached the tumor three inches deep, an amount of ray so small that it would not have any beneficial effect and might even stimulate the growth. The accompanying diagram (Diagram

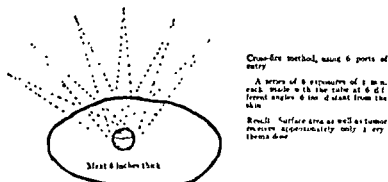


Diagram 3

1) shows the position of the tube and pastilles, and includes a comparative table of the doses administered on the surface, and one, two, and three inches below the surface.

Experiment 2, illustrated in Diagram 2, indicates the wonderful possibilities of the highly penetrating rays from the Coolidge tube, filtered adequately, and administered through six ports of entry by the cross fire method. In this test one Coolidge tube was used, operated at a high penetration by a standard four KW transformer, according to the table on the diagram. The soft rays were filtered out with three millimeters of aluminum. Six exposures of one minute each were sufficient to obtain a dose three inches below the surface. The use of six ports of entry eliminates the danger of burning the skin so that each surface area receives only one erythema dose. As our experiments were made on a piece of meat this precaution was uncalled for (Diagram 3).

These tests were used as a basis for the therapeutic application of the roentgen rays to deep-seated growths, particularly malignant growths.

By gradually increasing the quantity of these highly penetrating rays, which had been filtered through three millimeters of aluminum, I found that from three to four times the standard erythema dose of four Hampson units could be applied to the surface, but it must be borne in mind that this applied only to the highly penetrating rays filtered through three millimeters of aluminum. I use the Sabroreud pastille and the Hampson scale for reading, and for the first series of treatments I give twelve Hampson units to blonds and fourteen to sixteen to brunettes.

This is obtained uniformly by the following technique:

The tube is placed in a specially constructed box, as shown in Diagram 5. It is cooled by a

blast of air from an electric blower and the air is forced out from each terminal to keep those cool. The anterior hemisphere of the tube projects down into the large end of a short lead cone and the small end of the cone is directed toward the growth to be treated.

The small end of the cone is placed about one inch from the surface of the body. In order to prevent the static current from snapping down upon the patient a small piece of lead impregnated rubber with a square hole the size of the small end of the cone is placed on the surface of the skin, and the position of the hole, that is, the area to be treated, is marked on the skin with indelible pencil.

Different ports of entry are obtained by changing the position of the tube or the position of the patient above the diaphragm. For pelvic lesions from six to ten abdominal ports of entry are used, and sometimes I have used from two to six posterior ports of entry, but except for the two lower ones I have little confidence in the posterior exposures on account of the intervention of the bony pelvis.

Theoretically, the ray diminishes as the square of the distance from its source, therefore, an object six inches from the focal point receives more than twice the quantity of rays that one at nine inches receives, even though no solid substance is interposed. A growth three inches below the surface would thus receive only about one half that on the surface even if the intervening tissues were not present.

Tests with pastilles corroborated this. A fresh pastille was cut in two, and one-half placed six inches from the focal point, and the other nine inches from the focal point without any solid being interposed. An exposure of four minutes, ten milliamperes circuit, eight inches parallel gap, gave a reading of sixteen Hampson

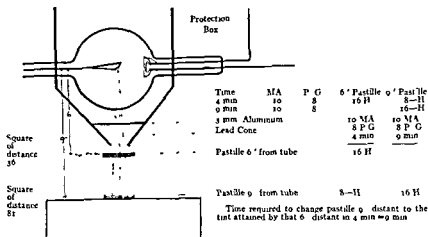


Diagram 4

units on the one six inches from the focal point, and eight Hampson units on the one nine inches from the focal point. In order to prove this and make it more accurate the pastille which was nine inches from the focal point was replaced, the exposure was continued, and it required five minutes more or nine minutes in all to change the color of that half of the pastille to a tint corresponding to that of the pastille which had received four minutes' treatment at six inches (Diagram 4)

Another similar test was made, using the same distance, spark gap, milliamperes, and time, but a

cake of paraffin three inches thick was interposed between the two pastilles. Paraffin was used because it is a little less dense than muscle so that it corresponds to the average density of the tissue interposed between a deep-seated tumor and the surface of the body (Diagram 5).

The pastille on the surface of the paraffin six inches from the focal point received sixteen Hampson units and the one beneath the paraffin, nine inches from the focal point, read 4+ instead of 8— as it would have read had the paraffin not been interposed, and it required a total of fifteen minutes to change the color of the pastille

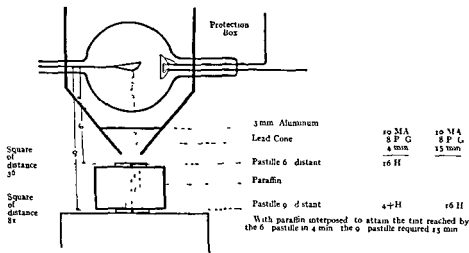


Diagram 5

beneath the three inches of paraffin and nine inches from the focal point to the same tint rendered to the one on the surface in four minutes.

Comparing these tests with those described in the previous communication where a piece of solid muscle was used instead of paraffin one notes that in order to obtain an erythema dose three inches below the surface from four to six times that amount (depending on whether fat or muscle is interposed) must be applied to the surface.

Tests concerning the burning qualities of filtered and unfiltered rays brought out the following conclusions:

An amount of unscreened X ray necessary to change the pastilles from zero to four on the Hampson scale is considered an erythema dose and six Hampson units is considered the limit of safety. If, however, a ray of high penetration emanating from a tube backing up eight inches parallel gap is screened by three millimeters of aluminum far more than four or six Hampson units may be safely applied to the skin.

In the treatment of desperate cases of cancer which were bound to die, I increased the amount of the highly penetrating screened ray until I was giving twelve to sixteen Hampson units, or three to four times the standard erythema dose through each port of entry. When these tremendous doses are given, care must be observed that the areas do not overlap, and scar tissue should be protected from getting the full force of the ray.

In one case which had been diagnosed as mediastinal sarcoma I gave twenty treatments through twenty ports of entry each one being three and a half inches square on the surface. Each treatment was given with an eight inch parallel gap ten milliamperes current, six inches distant from the skin, four minutes' time, dose twelve to sixteen Hampson units.

With the old type of tube and without filter or cross fire, six Hampson units was about the limit that could be applied to the skin. If this were directed toward a tumor three inches below the surface only about one-sixteenth of the energy would reach the tumor, therefore the tumor would receive about three-eighths of one Hampson unit.

172 H



190 H



Showing relative amount of X R applied to tumor mass by the unfiltered angle port method and by the highly filtered cross-fire method.

Diagram 6

Now with this mediastinal tumor twelve to sixteen (fourteen average) Hampson units were applied to the surface every day except Sunday. One fourth of that or an average of three and one-half Hampson units was applied to the growth itself at each treatment and twenty ports of entry were employed for each series; therefore, three and one-half times twenty or seventy Hampson units were applied during the first series and by the time the first series was completed the skin over the area first treated had so far recovered that we repeated the procedure, beginning the second series within ten days after the first series ceased. With each dose of this series about twelve Hampson units were applied to the skin and about three Hampson units reached the tumor mass. Twenty more exposures were given, making sixty Hampson units, or a total of one hundred thirty Hampson units applied to the tumor itself, more than one hundred fifty times the amount that could have been applied without the high penetration rendered possible by the Coolidge tube, the screen and cross-fire method of exposure.

Two months later a third series of twenty treatments was given, making a total of one hundred ninety Hampson units applied to the tumor mass as compared with about one or one and one-half Hampson units that could have been applied to them with the standard tubes without the screen or cross fire (Diagram 6).

INTERSIGMOID RETROPERITONEAL HERNIA

By J C BLACK, M D, REGINA, SASKATCHEWAN

AN intersigmoid retroperitoneal hernia is one of the rarest of all forms of hernia, so much so that J B Murphy, in the August (1914) number of the *Clinics*, reports a case and says that Moynihan claims that there are only two other cases reported in the entire medical literature previous to his. I thought that this case would prove interesting to the profession inasmuch as a tentative diagnosis was made before the operation—which is unusual, as these cases are generally diagnosed only at operation when strangulation has occurred. The patient, being a very intelligent person and having formerly been a nurse, was able to state her symptoms clearly and so aided very materially in making the diagnosis.

The main features about the symptoms were first the history of a fall, immediately followed by a pain in the lumbar region of the spine and in the left iliac region. This was followed by constipation and inability to assume the left prone position or do much walking, but she could lie with perfect comfort on the right side. This would be explained by the fact that a coil of intestine would enter the hernia while walking or lying on the left side and so cause pain, which would be relieved after lying on the right side for a time, as the intestine would then slip out of the hernia.

The patient was a married woman, aged 34 years. A little over two years ago, when about seven months pregnant, the patient slipped and fell on the sidewalk, alighting squarely on the buttocks. She was immediately seized with a sharp pain in the back which radiated into the left iliac region. This pain continued throughout the remainder of pregnancy, which terminated at the end of the eighth month with a normal delivery, and a feeble male child was born which only survived its birth eight hours.

On the fifth day of the puerperium the patient's left leg swelled and she was seized with violent pains which radiated from the leg to the left iliac and lumbar region of the spine. This continued for about a month, and during this time the temperature remained practically normal, and only on two different days did it go to 100°. At one time, when the swelling was great, we were undecided as to whether fluctuation

was present or not, and a tentative diagnosis of psoas abscess was made. Finally this all cleared up and the patient gained weight, but the pain in the lumbar region of the spine and in the iliac region continued. Tenderness also was present at a point about midway between the left anterior superior spine and the umbilicus, but no tumor was ever felt. The patient also noticed that she was unable to lie on the left side, as the pain was thus increased, walking also increased this pain. Constipation was another marked symptom, purgatives at times were useless, but an enema would generally relieve the distress.

After suffering with these symptoms for about six months the patient went to a hospital, and returned with a diagnosis of sciatica due to phlebitis following pregnancy. X-ray pictures were taken and no sign of any involvement of the spine could be made out, so that psoas was ruled out of the diagnosis.

After returning home the patient still had the symptoms and had not recovered from the lumbar and iliac pain, as she had been led at the hospital to expect. I was again consulted about the beginning of December, 1914. At this time constipation was very severe, and the pain at times was excruciating, so that the patient was kept awake all night and was unable to attend to her household duties. An enema would often relieve the symptoms for a time, but on assuming the left reclining or upright posture, the pain immediately began again. The probability of a hernia into the sigmoid mesentery was explained to her, an operation advised and performed on December 8, 1914.

A small hernia between the two peritoneal layers of the mesentery of the sigmoid was found. The hernia would just admit two fingers, and was about one and one half to two inches deep, and was situated about two inches from the root of the right side of the mesentery. The peritoneum lining this cavity was dissected out, and the opening was closed with silk thread. The appendix was removed and the abdomen closed. Recovery was uneventful, except for considerable vomiting—which was controlled by stomach lavage—and a small hematoma which developed in the rectus as a result of the vomiting, but which subsequently subsided.

INTRA-ABDOMINAL USE OF OXYGEN

BY G. KIRBY COLLIER, M.D., F.A.C.S., SONOMA, NEW YORK

THE use of oxygen intra-abdominally following surgical procedures was, we believe, first introduced in America by Dr. William Seaman Bainbridge of New York. While attending the Clinical Congress of Surgeons of North America in New York City in November, 1912, it was my good fortune to see a number of abdominal operations performed by Dr. Bainbridge in the greater number of which oxygen was used intra-abdominally.

We followed one of his patients to the ward, and noting the very rapid recovery from the anæsthetic and the apparent absence of shock, we decided to try this procedure in a series of cases.

Its technique is most simple. The ordinary tank of oxygen with its wash-bottles, as is found in every operating room, a length of rubber tubing and glass tubing, are the only appliances necessary for the procedure. The rubber tubing is attached to the wash-bottle through which the oxygen passes, and a few feet from the wash bottle a rubber coil, placed in a basin of hot water to keep the oxygen at a temperature of 100°F, or thereabouts, is attached. To the end of this coil is attached sterile glass tubing with the proper angulation to permit of introduction into the abdominal cavity and to prevent interference with the proper closure of the wound. Before the closure of the peritoneum is completed, this glass tube is introduced, being sewed tightly into the wound. Then the remaining layers of the abdominal wall are closed in the usual man-

ner, the glass tube still remaining in position. During the entire time oxygen is allowed to pass in slowly. After the complete closure of the abdominal wound, the oxygen is continued until there is a very considerable distention of the abdomen, when the tube is gently removed, the small opening left, quickly closing and not permitting of the escape of any of the oxygen. This procedure is very simple and requires no extra time, as the sterile glass tube to be introduced into the abdomen lies on the instrument table, and the connection is readily being made by one of the nurses while the surgeon closes the abdominal wound.

We have now used oxygen intra abdominally in twenty-five laparotomies, and the results have been most favorable in all.

The lessening of shock, the absence of nausea and vomiting, and the early recovery from the anæsthetic have been the most marked features of its use, and we have not in any case seen any untoward effects.

The absorption of the oxygen is quite rapid, and even though there might be some apparent embarrassment of the respiration due to overdistention of the abdomen, we have never felt that this was an element of fear, owing to the rapid absorption of the gas.

The distressing post operative results, so often seen, have been eliminated in those cases in which oxygen has been used, and we believe there will be a more widespread use of this valuable adjunct of the surgeon.

TRANSACTIONS OF SOCIETIES

CHICAGO GYNECOLOGICAL SOCIETY

REGULAR MEETING WAS HELD APRIL 16, 1915, WITH THE PRESIDENT, DR ROBERT T. GILLMORE, IN THE CHAIR

RETROCAECAL TUMOR IN THE MALE

DR ROBERT T GILLMORE This patient, Mr W. L., is married, 37 years of age, and occupies a position as sales manager When I first saw him he complained of a dull pain, across the lower part of the abdomen, which had existed since October, 1914, and was accompanied with nausea On October 14, 1914, two hours after eating fruit, including grapes, he suffered with severe, sharp, piercing pains across the upper part of the abdomen These pains were colicky in nature, lasting one half minute at a time, and were about 15 minutes apart He vomited a number of grape seeds A movement of the bowels did not relieve him There was no blood in the stool About this time the patient noticed a hard mass, the size of an egg, in McBurney's point This mass remained stationary until within a few weeks of the time I saw him, when it began suddenly to enlarge February 20, 1915, the patient suffered with a heavy sensation which was suggestive of a "strong" pain At that time he was in Sacramento, California, and consulted a physician who diagnosed sarcoma and advised him to go home immediately The following day his pain and nausea were more marked The patient always has been inclined to loose bowels and this condition was not modified with his indisposition

There is a history of mumps and measles during childhood The patient has had gonorrhoea twice In 1904 he had a venereal wart on the back of the foreskin and small sores on the face At this time he received an injection of "circinophyl"—a quack medicine—and there was a temporary improvement

His mother died at the age of 64, of pneumonia His father is living and well There is no family history which will throw any light on the patient's present condition The patient is temperate in alcohol, although an inveterate smoker He does not drink tea or coffee His skin is clear There is no oedema His pupils are equal, regular, and react normally to light. He pre-

sents a slight pharyngitis The chest, heart, and blood-vessels are normal

On abdominal palpation there is marked bulging below the umbilicus, which is more pronounced on the right side The tumor is as large as a medium-sized muskmelon and occupies the right lower quadrant, from the umbilicus, extending three inches to the left of the median line There is tenderness over the tumor The patient has lost about twenty pounds Urinary analysis was negative

Dr Robert Preble saw the patient in consultation and suggested an X-ray in order to determine the diagnosis The picture of the bismuth lined intestine showed it somewhat dilated, apparently lying above the tumor

Diagnosis The clinical findings were suggestive of sarcoma, or some malignant growth

Operation An incision was made over McBurney's point and a large, hard retrocaecal tumor was disclosed which seemed to be attached to the head of the caecum The appendix was found without mesentery, lying flattened over the top of the tumor The pathological finding was that of a myxofibroma One of the small tumors on his face was removed with negative findings as to malignancy One of the glands behind the tumor was taken out for laboratory examination, and the pathologist reported that there was no malignancy

The patient made an uneventful recovery and has been steadily gaining in strength and weight

DR T J DOEDERLEIN I am quite interested in this case because the man is a neighbor of mine His wife told me about these tumors he had on the face and I saw them, after they were removed, in a glass She had a number of them in alcohol She claims he went to a specialist, either in Boston or Philadelphia, who told her it was a cancer He injected arsenic or some solution of arsenic When I heard that he had this enormous tumor of the caecum I thought it might be a sarcoma, but I am pleased

Meyer, who was much interested in it, I have had the patient brought here to show the result four weeks after operation.

Four weeks ago this child was operated on at St. Luke's Hospital for a very pronounced hydrocephalus. The operative interference was made necessary by the baggy condition of the head, the bulging eyes, and bulging fontanelle, showing that the child was rapidly going to pot with the typical symptoms of hydrocephalus. There was a passage way between the spinal canal and the cranial cavity. A spinal puncture to reduce the tension in the fontanelle secured prompt reduction, showing that there was something to be gained if we could establish a channel between the interior of the ventricles and the outer surface of the brain, because the fluid on the surface of the brain could be emptied into the spinal canal, and equilibrium established in that way.

The procedure undertaken was that which has been recommended by Anton, and in this particular case it proved peculiarly efficacious. Instead of a bulging fontanelle, we have now a normal fontanelle which is rapidly closing in. The whole skull, instead of being baggy, is settling, and the fontanelle, instead of bulging out, is really depressed. The technique employed is simple for a cranial operation. An opening is made about a centimeter and a half posterior to the junction of the coronal suture, with the longitudinal suture, a small flap is turned back, and at one half to three quarters of a centimeter from the middle line a small opening is made in the dura to avoid the large median vein. Then, with a small ureteral silver catheter with multiple perforations on the side of it, or with a special instrument similar to the one that Anton devised (I used a silver ureteral catheter), one pushes the instrument, with its point in contact with the falx cerebri, down to the corpus callosum. This offers a delicate resistance, but with a little pressure the instrument enters the lateral ventricle and the water begins to flow. After an amount of fluid is allowed to escape from the ventricle, a slight sweeping motion is made to tear a permanent hole in the roof of the ventricle to allow escape to the subarachnoid space. If there be a free connection with the spinal canal, the patient is apt to be benefited. The child upon whom the operation was done is fifteen months old, and is now able to sit up, calls for food, and is quite observant.

This procedure is about the best form of decompression that can be done in cases of tumor if one can determine on which side the greater amount of pressure is. With an instrument introduced into the ventricle, one secures a considerable quantity of effusion when there is a cerebral tumor. Provision is made for the escape of the fluid. In this way it makes a decompression to exceed temporal decompression, and symptoms sometimes will make it possible to localize a cerebral tumor which other wise would not be revealed. In this case there was no bone, but simply soft cartilaginous membrane.

CARCINOMA OF THE RECTUM

Eighteen days ago I removed a carcinoma of the rectum in this patient. It was a rectal carcinoma in the sense that it was very extensive, extending from an inch and a half within the sphincter to well beyond any possible reach of the finger. The preliminary operation which had been done revealed extensive glandular infiltration in the mediosacral region, which made it necessary to do a wide resection. At the preliminary operation was made the artificial anus to which I desire to call your attention.

First, there is the median incision for the purpose of determining whether a temporary or artificial anus shall be made. Second, having determined what shall be done, before interfering with the bowel, an incision is made in the usual position for removal of the appendix, but on the left side and so situated that it shall be close to and well below the anterior superior spine, then, having a loop brought through, a cutaneous incision is made between the anterior superior spine and the anterior inferior spine but a little external to it, because there is a bony background between these spines against which a large belt may be worn with a pad on it.

When one introduces the finger into such a fistulous tract, there is found a receptacle in the abdominal wall external to the muscles, but beneath the skin, which with the bony background can be compressed. With a flushing in the morning the bowel can then be left for the day without further treatment. We did not make absolute control because we have not yet completed the final stage of the operation, which is to remove the excess of mucosa, which I think is desirable to have until adhesions have taken place. We draw the bowel through an inch or more, let the adhesions form, and later remove the excess of mucosa and bowel wall. This will be done with cocaine anesthesia, flush with the skin, and we will have a normal anal margin with mucocutaneous junction. In this case there were seven inches of bowel resected because the sacral glands were involved, necessitating a Kraske operation.

In the removal of a carcinoma of the rectum, one sometimes desires to make a temporary artificial anus, or sometimes a permanent artificial anus. For a permanent artificial anus, the bowel is resected and the ends brought out. When you want to make a temporary removal by a spur I have found a very satisfactory thing is to modify the ordinary glass tube recommended by Madyt by having a bend in it beneath the loop so that the loop of bowel will not be out flush with the skin.

CARCINOMA OF THE CAPUT COLI

I have had this patient come down here tonight because his case illustrates one of those instances in which it is difficult to make a diagnosis, and on that account I thought it would be of interest to present him.

This man presented himself with a chronic appen-

ditus He had temperature, he had tenderness, and he had a tumor He had been seen by Dr Herrick, who pronounced the case one of carcinoma of the caput coli, and he was referred to me for operative interference Because he had temperature, pain, and a leucocyte count, and because I had had a similar experience with Dr Herrick, and because I was right the first time I thought I would be right this time It was a case in which the appendix was wrapped in the omentum, so that it would move around in the abdomen without any attachment to the anterior abdominal wall and gave one all the characteristics of a movable tumor of the head of the colon Both of us were right It was a carcinoma of the caput coli with an appendicitis caused by cancer occlusion, necessitating removal of the caput coli with implantation of the ileum into the transverse colon

When I finished the operation and began to count the sponges, I was told one was missing However, in introducing my hand into the bottom of the pelvis I pulled up a mass which proved to be a carcinomatous implantation on a loop of the small intestine This was resected, and circular suture made with end to end implantation of the bowel The patient has had no distress since the operation

BONE CYST

This man had a tumor in the lower end of the fibula that was tender and looked vascular, and there was every reason to feel from the elasticity of it and the clinical history that it was a sarcoma of the lower end of the tibia Before resorting to amputation, removal of some of the growth was advised Upon opening it there was found a fibrocystic mass which could be shelled out in a solid lump and which proved to be a bone cyst

The fact that it is a bone cyst is of little interest to you, but I thought it would be of interest to you to know that I closed the cavity immediately, filling it with a chunk of fat taken from the thigh By dissecting out a piece of fat after the suggestion of Makkas, I was able to effect primary closure, and the man has a good result It is now four weeks since the operation was done The large cavity left by curetting such a bone cyst out is an annoyance to a man who has to earn his living, he cannot afford to stay in the hospital a long time, hence it is a matter of financial interest to get him well quickly In that way one can do it One should not hesitate in a case of bone cyst to fill in the cavity with Mosetig Moorhof plug, with Beck's paste, or with any other material that will obliterate the cavity It is better than the blood clot that has been so frequently recommended

CARCINOMA OF THE RECTUM

DR CARL B DAVIS The first case I present, some of you have seen before I show her as a good example of what may be accomplished by removal of carcinoma of the rectum by the combined operation This woman was operated upon

four years ago, and is still in good condition The anus is not of the same type as that described by Dr McArthur, but is controlled to the satisfaction of the patient.

The incision was made through the median line, the bowel brought up through the muscles underneath the skin, and stitched to this point (indicating), so that she has had control of the faeces The rectum was removed by the Krasko route She has gained thirty pounds in weight since the operation One patient on whom I operated has gone seven years without recurrence of the disease

The next patient was operated upon a year ago. The same operation was done in her case as in the other She has gained about forty pounds

In both of these cases there is a loop of colon extending several inches below the level of the artificial anus The patients flush the accumulated faeces from this loop each morning and as a rule do not have any escape of faeces until the next flushing

A CASE OF SIMULTANEOUS SARCOMA AND CARCINOMA OF THE FACE

DR. KELLOGG SPEED The patient is a male, 68 years old, a carpenter Ten years ago he noticed a small growth on the anterior portion of the right temple This was hard and reached the size of a walnut three years ago when it was removed There was recurrence, and removal followed again 6 months before he was seen In the last three months the tumor has reached the size of a large hen's egg, growing faster than ever before It is soft, not painful or tender, and is partly movable, evidently not adherent to the skull It had a bluish red color, was spherical in shape, and the surface was excoriated and covered with crusts

Behind and below the right ear is a crust covered ulcerated area in the skin and subcutaneous tissues, the edges of which are reddened and infiltrated. This has been present several years

The large tumor was moist and bloody on section Pink color Microscopically it is made up of a loose network of spindle cells whose nuclei are large, variable in size and shape and stain deeply Microscopic diagnosis spindle cell sarcoma

The small tumor was grossly an elevated area about the ulcer with indurated edges After the crust was removed the surface was pink and moist. It cut with slight resistance and microscopic sections demonstrated a lawless overgrowth of epithelial cells suggesting a mildly malignant growth

Both tumor masses were removed by wide excision The larger seemed to originate from the superficial layer of the temporal fascia The temporal muscle and all tissues down to the periosteum were removed The wound is granulating slowly

DEATH FROM PYLORIC STENOSIS FOLLOWING THE INGESTION OF HYDROCHLORIC ACID

DR KELLOGG SPEED The patient was a male aged 33 years, a brass finisher who had never been

sick in his life. Two months before consultation he had swallowed a full glass of muriatic acid by mistake. This contains 37 per cent hydrochloric acid. This did not burn much, but he felt pain in the stomach and vomited some of the acid. His stomach was washed out some hours later and he was treated in the hospital for three days. He left feeling normal and had no trouble until 6 weeks later, when he began to experience colicky pains in the epigastrium after eating and vomited everything he ate. There was no difficulty in swallowing and he has had few and small bowel movements with three- and four-day intermissions. Urination about as normal. There has been 20 pounds loss of weight in the three weeks before seeking treatment; and beyond a progressive weakness and hunger he has had no other symptoms. Physical examination negative except his apparent loss of weight and weakness and the evidence of an enlarged stomach with visible peristaltic waves. The distended stomach's lower border was at the umbilicus and there were distinct peristaltic and antiperistaltic waves across the epigastrium. Seven hours after an 8 ounce barium meal, practically none had passed the pylorus.

Urine: some albumin and finely granular and hyaline casts. Blood hemoglobin, 80 per cent; white blood corpuscles, 8,600.

Both fluoroscopic and roentgen plate examinations showed no defects in the stomach and a practically closed pylorus. Because his condition became weaker, gastro enterostomy was decided on.

At the operation the stomach was large, with injected vessels and a constricted area on the lesser curvature. The first part of the duodenum and the pylorus were shrunken and flattened. There were a few fibrinous adhesions about the pylorus, but on palpation there was no thickening or indurated area around a possible ulcer within. Small bowel and colon very contracted, the transverse colon about the width of a thumb. Gastrojejunostomy was performed, followed by death in three days.

Autopsy report. The anatomical diagnosis was cicatricial contraction with nearly complete closure of the pylorus. Cicatricial contraction of the lesser curvature with beginning hour glass stomach, recent laparotomy with gastro jejunostomy, bilateral hydrostatic congestion and pneumonia, a few calcified lymph glands, parenchymatous degeneration of the kidneys and emaciation with atrophy of the viscera.

The man was practically in a starved condition. The result of the ingestion of the acid was unusual in that the esophagus was not damaged and the pylorus and duodenum received the greatest effect. Earlier gastro enterostomy would probably have saved his life. Remote effects from burns due to strong alkalis and acids should be borne in mind

DISCUSSION

DR JACOB FRANK. It is not often that one has the opportunity of seeing so many of these cases,

and the name given them by Dr Schrager is a new one for an old disease. I have had six patients with this disease in the last twenty-five years and have diagnosed them as meso arteritis obliterans, although they have also been called intermittent claudications.

We have two such cases now at the German Hospital, one a man from Galveston, Texas, upon whom I operated seven years ago. Dr. Andrews will probably remember the case, as he saw it with me in consultation, and we decided to amputate the leg. One leg was amputated at that time and recently the man has returned and has had the other leg taken off. The leg amputated seven years ago was examined by Dr Herzog, who found that both the arteries and veins were diseased.

I mention this because I cannot see wherein it will do any good to resort to arterovenous anastomosis when the veins are diseased. A Wassermann test was made and found positive in this case.

The other case now under observation came from the County Hospital, where a diagnosis of tuberculosis of the os calcis was made. When the patient came to me, I found a small painful bleb on the heel which he had had for months. I incised it, and on account of the fact that there was no bleeding decided at once that it was a case of meso arteritis obliterans.

In reference to the cases of cancer of the rectum, I recall an extreme case of this disease in a woman where I took out the glands and did such an extensive operation that she had paralysis of both legs and almost uncontrollable pain for some time. An artificial anus was made, and now, five years after the operation, she is living and well.

I think where the glands are removed, the bowel dissected high up, and an artificial anus made, the chances for permanent recovery are excellent.

DR DAVID C STRAUS. I would like to mention a form of treatment which I believe is of real value in these cases of thrombo-angitis obliterans, and that is Koga's treatment—hypodermoclysis with Ringer's solution. I first saw the effect of this form of treatment last April in New York, at a clinic held by Dr. Willy Meyer for the members of the Fourth International Surgical Congress. He showed four cases of presenile gangrene or endarteritis obliterans, in which he had tried the Koga treatment with very gratifying results in all four cases, as far as he had gone. In these cases he injected subcutaneously 500 ccm of Ringer's solution every second or third day, giving two or three injections a week. In these four cases a Wassermann test had been made and was negative.

Koga, the originator of this method of treatment, in his original report, published complete protocols of 13 cases of presenile gangrene in young individuals, all with negative Wassermann. In the early cases, he used daily infusions of 400 ccm of normal salt solution, later he used 400 ccm of Ringer's solution daily. In all 13 cases there was definite relief in that the pain, coldness, and intermittent claudica-

tion rapidly lessened and eventually disappeared entirely, the edema and cyanosis gradually disappeared, a sharp line of demarcation formed, ulcers rapidly cleaned up and healed over, and in some cases certain peripheral arteries which, before the infusion, were pulseless, began to pulsate. In all these cases the viscosity of the blood was above normal before beginning treatment, while during the treatment it gradually fell to normal or below normal, and remained low. The improvement in symptoms went hand in hand with the fall in viscosity of the blood. One or two cases had to be re-injected later, but responded just as nicely the second time. So far as clinical symptoms were concerned, they were definitely relieved for a long time, the first case for two years.

Since last April I have an opportunity, through the kindness of Dr. L. L. McArthur, to try this treatment on two patients and both of them have responded nicely. The first patient, a woman of 65, had had the disease since she was 37. She had her right leg amputated just below the knee, three years ago, for gangrene of the foot. Since the amputation she has had pain in the stump and recently has had beginning symptoms in her left foot, at first numbness, and later pain in the toes, redness, and absence of pulsation in the dorsalis pedis tibialis posterior arteries. I began treating her early in January, giving her an infusion every other day, beginning with 500 ccm. of a modified Ringer's solution and later increasing to almost 1,000 ccm. each time. After the sixth infusion she had no more pain in the left foot—only some numbness, and after the tenth infusion the left foot was entirely free from all symptoms and the amputation stump was greatly relieved. In all I have given her 23 infusions. While she still has some occasional pain in the stump she has been greatly benefited, and the left foot has remained entirely free from all pain.

The second case was a middle aged man, who had his right leg amputated below the knee one year ago, for presenile gangrene of the foot. He consulted Dr. McArthur because of pain at the end of his stump, which always felt cold and rather lifeless. I have given him eight injections at intervals of three or four days, that is twice a week. I gave him only 500 ccm., or a little more each time, because he was rather thin and had little subcutaneous fat, and would complain of tension and pain, whereas the first patient, having plenty of adipose tissue, could tolerate a great deal more fluid. The man, up to the time I first saw him had been able to sleep only three or four hours each night because of the pain, now he sleeps well and is very enthusiastic over the relief he has received. Although there is still a tender spot at the end of the stump where the skin is adherent to the bone and a very small moist point in the scar nearby, the stump is now free from pain, feels warm to him and looks pink instead of being very pale as it was before treatment was begun.

A few weeks ago when Dr. Meyer was in the city I asked him if he was still using this form of treatment, and he said that he was more enthusiastic than ever over it, that he now has 18 cases in which he has tried it, and will publish his results in the near future. He is absolutely satisfied that it does good and thinks it is worthy of trial before resorting to arteriovenous anastomosis or amputation.

I asked Dr. Meyer what effect he believed the solution had, and he said he believed it probably altered the blood in some way. Personally I also believe the solution alters the blood in such a way that it can pass through the blood-vessels more easily.

DR. CARL BECK. The case of hydrocephalus presented and reported by Dr. McArthur is interesting from the standpoint of the excellent result he has obtained. We have had so far very little success in the treatment of this condition. The method which he has described is one that ought to be more frequently practiced than simple decompression. It is simple and easily performed, even with cocaine anesthesia.

Some years ago we tried the method of introducing a vein into the brain so as to establish permanent drainage. The vein heals in, but we have found that it does not keep open as permanent drainage. It closes after a while, and I think this method of "Birkenstick" is the best form of treatment.

The cases reported and exhibited by Dr. Schragar do not belong to the class described by Dr. Frank as mesoarteritis obliterans or endarteritis, but they are pathologically a distinct entity. Every surgeon sees many cases of gangrene in young people that are due to endarteritis obliterans or ischaemia.

The term mesoarteritis is a misnomer. Endarteritis obliterans is characteristic of chronic syphilis. It can be shown easily under the microscope that there is a development of endothelium, which gradually leads to obliteration of the vessel and to ischaemia with the resulting gangrene. But these cases presented by Dr. Schragar belong to the particular class of angiospasm or to some other condition which has not been clearly defined and which leads to thrombosis.

It is a young individual who develops gradually these symptoms of slow gangrene alternating with health and it is confined more or less to a certain race—the Jewish race. I have seen this gangrene in a number of cases. I have seen it in a young man who was non-Jewish although his name was Israel. He was the last case we had.

These cases have done very well with the operation of arteriovenous anastomosis. Dr. Halstead has described a case in which I resorted to arteriovenous anastomosis with success.

I have found in the last case a simple method which has led to a cure of the case. This method has been recommended in Germany for other cases of the kind, that is immersing the leg into hot

and cold water, alternating in quick succession. We did that two or three times, and it was remarkable to see how good the circulation became in the leg, which before showed no tendency toward healing.

It is an angiospasm or some angioneurosis which leads to the development of gangrene, and it must not be confused with endarteritis obliterans, because none of these cases show a Wassermann reaction.

DR. DAVID C. STRAUSS: The eleven cases reported from the Japanese clinic, the four cases Dr Meyer showed, and the two cases I have mentioned, all showed a negative Wassermann test.

I would like to say also, that careful dissection shows, as Luerger says, that the chief thrombus usually occurs in the popliteal rather than in the smaller vessels. While there is no pulsation in the peripheral arteries, they may nevertheless be patent and the chief thrombus is usually higher up. In one case in which I made a careful dissection, the thrombus was absolutely limited to the amputation area. The thrombus was limited to the popliteal artery and vein and lower than the popliteal vessels the lumina of the various branches of the large arteries were not entirely obliterated or not at all involved, and I think possibly in some of these cases it might be well to do transplanation of the involved, and I think possibly in some of these cases it might be well to do transplanation of the saphenous vein or some other artery to take the place of the artery in that portion, if we could determine roughly where that portion be.

DR. L. L. McARTHUR: I want to confirm what Dr Strauss has said with reference to the treatment recommended by Dr Meyer in two cases. These patients had been addicted to opiates and it was necessary for them to take large doses to get relief, but they obtained more relief after the use of Ringer's solution given hypodermatically.

DR. A. J. OCHSNER: In my personal practice I have found that this condition occurs principally in two nationalities, Jewish and Swedish. The patients that have come to me were erratic in their eating. They ate much salted meat and under a salt free diet several of them improved considerably, and in several of them the primary necrotic ulcer has healed without an operation. The fact that people of a certain nationality have this condition more frequently than those of other nationalities indicates that they do something that other people avoid or they would not develop this condition.

If Ringer's solution has been modified, it would be interesting to know in what way this was done.

DR. DAVID C. STRAUSS: In looking up the formula for Ringer's solution, one will find that many different formulae are given which are slight modifications of the original Ringer's solution. The solution I used was simply one of these various modifications, and consists of

- 0.9 per cent NaCl
- 0.024 per cent CaCl_2
- 0.042 per cent KCl
- 0.02 per cent NaHCO_3

SYMPOSIUM: CARCINOMA OF THE RECTUM

DR. L. L. McARTHUR read a paper entitled "Carcinoma of the Rectum" (see p. 495).

DR. CARL B. DAVIS followed with a paper entitled "Mortality and Progress in Operative Treatment of Carcinoma of the Rectum" (see p. 497).

DISCUSSION

DR. CHARLES DAVISON: I think Dr McArthur and Dr Davis have covered pretty well the subject of the surgical treatment of carcinoma of the rectum. Only a few years have elapsed since operations for carcinoma of the rectum were attended by an extremely high mortality, leaving the patients in a horrible condition while they lived, with recurrence of the disease sooner or later, and death from recurrence. It is not beyond the memory of some of the older surgeons in this room when an operation for carcinoma of the breast was considered a death warrant. When the tumor was simply removed from the breast and the glands in the axilla were left alone, the patients all died. But under the direction and teaching of such men as Halsted, Rodman, Warren, and others, we later learned that it was important to take out the lymphatics and their connections. Surgeons are beginning to learn that a similar development in technique offers some thing for carcinoma of the rectum. It is only by following out the anatomical circulation of the lymphatics and going beyond the infiltration of the tissues that any prospects of success are likely to be attained. The general consensus of opinion of surgeons now seems to be in the line of the two-step operation, and the former high mortality of 50 per cent has been reduced by the best operators in the last two or three years to only 12 or 14 per cent.

The operation consists of opening the abdomen in the middle line, dissecting free the diseased intestine well above and below the tumor, cutting across the intestine well above the tumor, entirely above the malignant infiltration, using the proximal end to form an artificial anus and invaginating the distal end and the tumor through the rectum to be removed as a second step of the operation at a later time.

Some of the best surgeons are making a simple artificial anus, using the rectus muscle as a sphincter. The rectus muscle is under mental control, as is the sphincter muscle of the rectum, and it probably makes as good a sphincter as the elaborate method that has been described tonight.

The development of technique along the lines of extensive careful dissection, following the malignant infiltrations and the lines of lymphatic drainage, it seems to me, will give these patients a fair prospect of life, possibly a prognosis as good or better than in any other internal cancer.

DR. C. WELLS ANDREWS: In company with Dr Ochsner and others we saw the demonstration of Hochenegg's work and the results of his technique in 1912 while visiting Vienna. Some of us had

seen the method before, and we were struck with admiration at the bloodless way in which he did the Kraske operation. We were particularly impressed by the enormous amount of material which he had collected at considerable expense and labor to show us. He had these patients brought from all over Austria, and some of them had gone as many as twenty years without recurrence of the disease. It was a highly interesting and instructive demonstration of a wonderful system and perfection of scientific records as well as a good percentage of cures. In spite of this, however, I cannot help but agree with what the speakers have said tonight, that we are drifting toward the combined operation of the upper and lower routes, the method described by Quénu and beautifully illustrated in a series of monographs by Tuttle of New York.

There are three points to be considered in the combined or upper loop operation. One is greater mobilization. This statement may strike you as paradoxical, the more you cut off the sigmoid, the more you can pull it down. You cannot draw the sigmoid down into the rectum unless you make a high section. If you go away up toward the wide loop, you can loosen it. There again, we have the advantage of splendid control of hæmorrhage, which helps materially if we do the combined operation. We cannot pass this point without stopping to pay a tribute to Dr. Carl Davis for his beautiful study of the arrangement of the vessels of the mesosigmoid. If you cut too high or too low, you take chances either of hæmorrhage below, or gangrene of the loop of the sigmoid by having one loop vessel too high. Working in the pelvis, you have a dry field. You are working in the Trendelenburg position, the intestines are out of the way, and there is a beautiful dry dissection of all of the tissues as high, or a little higher, than the promontory of the sacrum.

The vital point is the hæmorrhage, which, to my mind, is the key to success in getting primarily a low mortality. I believe the high mortality connected with the Kraske type of work is due largely to the shock produced by the loss of blood in the different steps of the operation. There is a way of making a bloodless operation by the sacral route, but most operators until a few years ago did not know it. When they went in above the by combined method they got a more bloodless field in which to work.

DR COLEMAN G. BUFORD. I was interested in the X ray plate exhibited by Dr. McArthur, which showed where bismuth paste had been injected into a sinus leading into the trachea and had been aspirated, causing pneumonia.

About three years ago a child of eight or nine years, suffering from what we supposed was a local empyema, was operated on by me at the Children's Memorial Hospital. The wound continued to discharge for many weeks, and I finally had my interne inject the sinus with bismuth paste, with

a view of having a radiogram of the chest made. To our surprise he reported the paste appeared in the child's mouth with astonishing rapidity and was spit out without causing coughing or other trouble. This seemed so unbelievable that I had him repeat what he had done in my presence, and found that his report was correct. We afterward used the bismuth paste for curative purposes. The sinus which had remained open so long, closed with surprising rapidity.

DR E. WYLLIS ANDREWS. In connection with what Dr. McArthur has said I am reminded of a case in which an enormous quantity of paste was accidentally insufflated into the trachea, and death resulted promptly from a general diffuse filling up of the bronchi and alveoli.

DR CARL BECK. In the cases cited by Dr. McArthur and by Dr. Andrews, the paste was evidently introduced into the mouth, but if it is introduced from below, as in Dr. Buford's case, it will not cause a fatal result. In many cases, where you inject bismuth paste into a fistula, and the patient coughs and spits up a large quantity of the paste and pus with it, it will be retained in cavities in the lung for a long time. There is a physiological explanation for the expectoration. The epithelium is ciliated in the upper trachea and bronchi. If we inject an abscess, for instance, which communicates with a large bronchus, the paste which goes in irritates the epithelium in the same manner as the discharge of the lung and creates expectoration, and the patient will expel it. If, however, bismuth gets into the small bronchi, where the cilia are not present, it cannot be expectorated. It was an aspiration pneumonia that Dr. Andrews' patient had, the bismuth paste had entered the small bronchi. If the cavity communicates with a larger bronchus, which has ciliated epithelium, the paste does no harm.

DR. McARTHUR. They were told to inject bismuth cream in a fluid state, so that it could be washed out. They introduced Beck's paste to get a photograph of the sinus. The paste was not used for curative purposes, but for diagnostic purposes to determine the course of the channel. Then, when they tried to wash it out, they forced it the wrong way, washing it down into the trachea. If the paste had been made with water, as advised, it might have been expectorated and would have come out of the small bronchi.

DR BECK. If they had forced the bismuth paste from an abscess into the trachea, it would have been expectorated. There must have been a small opening in the trachea through which a little of the paste passed gradually and then was aspirated, which, in an asthmatic patient, would naturally result fatally through aspiration pneumonia.

DR A. J. OCHSNER. I wish to speak of some points that are of practical importance. For many years I carried the intestine out directly underneath the lower end of the sacrum, thinking that in this

position the pressure of the intestine against the sacrum would serve as a valve which would add to the comfort of the patient. Some years ago, when Professor Graser was visiting Chicago, I happened to have a case in which I made an excision for cancer of the rectum, and he told me that it would be better to carry the intestine directly down in the center of the incision and leave an opening in the soft tissues. I carried out his suggestion, fastening the intestine by means of a number of strands of chromicized catgut, so that the tension came on the outer portion, and the result was so much more satisfactory than it had been with the old operation that since then I have constantly performed this operation and have found that the patient is really much more comfortable than when the opening was made higher up directly underneath the sacrum.

When one makes an excision of a very high carcinoma of the rectum and uses the method described by Gibson, placing a rubber tube in the upper segment, and drawing this into the lower segment, the upper segment should be twisted in one direction and the lower segment in the other direction, so that where there is no peritoneal covering of one segment there shall be peritoneal covering on the other. This is the same principle that Murphy pointed out many years ago in connection with all end-to-end anastomoses, but in this particular operation it is of the greatest importance, because if this is not done there is sure to be leakage.

One should not take too large a rubber tube, because the lower segment is often very much smaller than the upper segment.

DR J. RAWSON PENNINGTON. Formerly the recognized division between the rectum and the sigmoid was at the point of the bowel opposite the left iliosynchondrosis. Now embryology seems to furnish a better explanation for this division and fixes it at about the middle of the third sacral vertebra. The rectum is developed from the post allantoic gut and is the fixed part of the bowel. It extends from the third sacral vertebra to the pectinate line. At the junction of the rectum and sigmoid, and at the pectinate line, there is a slight constriction in the bowel. Near the former is located one of Huston's valves. One, and sometimes two, additional valves are located in the ampulla. These constrictions and valves favor traumatism, which is a predisposing cause of cancer. It is quite generally conceded that cancer never initiates in healthy tissue, but that it has a tendency to attack tissues that are already injured or diseased.

The treatment of cancer of the rectum is preventive, curative and palliative. The former is by far the most important. The next in point of importance is the curative treatment.

As to the curative treatment I believe that the perineal, Kraske, and other operations done from below exclusively should be less frequently performed, if not condemned. Miles, of London, found by post mortem examinations that in cancer of the rectum and the distal part of the sigmoid there were three directions of spread—the upper, lateral, and downward spread—and that it made very little difference as to the degree of spread, whether the cancer occurred in the lower part of the rectum or the distal part of the sigmoid. From these observations he planned a method of operating which he called the abdominoperineal operation, with an inguinal colostomy.

The technique in part is as follows: The patient is placed in a high Trendelenburg position, an incision made from the pubis to the umbilicus. The left ureter is located so as to avoid injuring it, and the inferior mesentery artery ligated. Then the sigmoid is divided and the ends closed. The mesentery of the sigmoid is then divided transversely back to the promontory of the sacrum. The peritoneum on each side of the bowel, and about one inch from it, is now divided down to the cul-de-sac. These incisions are carried forward so as to meet in front of and between the bladder and rectum in the male, or the vagina and rectum in the female. The bowel and all tissues posterior to it and in front of the sacrum are detached down to the coccyx. The rectum is next detached anteriorly and laterally. The distal portion of the bowel is carried down into the pelvis and the peritoneum closed over it. The abdominal wound is then closed and the patient is placed on the left side, the coccyx removed and the operation completed. According to the last report which I saw he had operated on sixty-seven cases. His recurrences were 7.4 per cent. Of these sixty-seven cases, thirty-seven are living and apparently well. He did his first operation in 1906.

I have done two of these operations. The technique however, I have varied slightly. First, I did not divide the sigmoid until ready to close. Second, in doing the perineal part of the operation I placed the patient in the lithotomy position, purse-strung the anus, did not remove the coccyx, but made an incision, as in doing a perineorrhaphy, and carried it around the rectum, so as to include the sphincters, and upward to meet the incision of the detached part of the bowel from above. The wound was dressed with a piece of rubber sheeting and gauze. This was removed at the end of seventy-two hours, and a dressing of drawn gauze and subnitrate of bismuth ointment applied. This form of dressing was repeated every forty-eight hours throughout the course of treatment. Both patients made an uneventful recovery.

BOOK REVIEWS

A CRITIQUE OF NEW BOOKS IN GYNECOLOGY AND OBSTETRICS

By GEORGE GILLHORN, M.D., St. Louis

THE present status of operative gynecology is very clearly set forth in the preface of a new book¹ on that subject "Gynecologic surgery," says the author, "is entering a new stage of development. The past may be designated the period of invention of methods. To such an extent has this been carried that for the treatment of uterine displacement alone more than one hundred operative procedures have been devised. The new stage of development may be designated the period of adaptation of operative methods to the exact pathologic conditions present in the individual case. This period of development is as important as the preceding one, perhaps more so when considered from the standpoint of lasting benefit to the patient." Instead of adapting all cases to one particular procedure championed by the operator, our treatment must be truly selective.

With this object in view the author has devoted fourteen out of the nineteen chapters of his book to the operative treatment of the various conditions encountered in gynecologic practice. Each chapter presents the technique of the different operations devised, the difficulties likely to be encountered, the indications for surgical intervention, and the selection of the exact form of operative procedure best suited to the particular case. For details of etiology, pathology, symptomatology, diagnosis and prognosis, the reader is referred to the author's *Textbook on Diseases of Women* which, in its second edition, appeared not long ago.

The opening chapters on retrodisplacement and prolapse are masterpieces of methodical, lucid, and exhaustive presentation of the matter. Fistulae, fibroids, carcinoma, ovarian tumors, inflammatory conditions, etc. are treated with equal exactness. The diction is clear and precise and seven hundred and seventy semidiagrammatic and instructive illustrations help to leave no point unexplained.

In two chapters, the general principles underlying abdominal and vaginal operations are discussed while an associated chapter gives minute instructions as to the after treatment. Chapter xviii presents a very interesting commentary on gynecologic surgery in nervous patients, and the concluding chapter, xix, deals with certain medicolegal points.

The wide experience of the author as an operator and a teacher manifests itself on every page, and it is safe to say that the book will meet with a warm reception on the part of the profession.

THE somewhat unusual title of a book² fresh from the press, raised in us pleasant expectations which were still further increased by the opening paragraph of the preface "The majority of the patients who come to the gynecologist for advice suffer from the effects of injuries sustained during labor. Often the actual pathology involved has not been recognized or, if recognized, has been underestimated by the general practitioner."

As all this is true enough and does not permit of discussion, the author had a splendid opportunity to do missionary work and to elevate midwifery from its present level to that of scientific obstetrics. Such an object, the author thinks, would be accomplished, were *trachelorrhaphies* and *perineorrhaphies* more correctly performed and their importance to the physical and mental well being of the mothers better understood. With this end in view he presents a detailed description of the anatomy of the cervix and perineum and the mechanics of the relaxed outlet, but he encumbers these chapters, as well as another on the pathology of the cervix, with a good deal of totally extraneous matter. It is, for instance, not clear why in connection with obstetrical injuries, infections and malignancy of the cervix should be elaborately discussed and illustrated with numerous microphotographs.

There is a profusion of illustrations many of them of only moderate didactic value, in this short monograph of 183 pages, yet, where they are most needed, we look in vain for them. The chapters on curettage and on immediate or delayed repair of birth injuries contain lengthy descriptions but practically no pictures of the various surgical steps proposed, which to the beginner would be more valuable than even the most graphic accounts of operative procedures.

But, one is forced to ask, does a book which lays its greatest emphasis on the surgical aspect, aim at the very heart of the question? Should the term "gynecology of obstetrics" be synonymous with "repair work" which in itself is so very often

¹ *OPERATIVE GYNECOLOGY*. By Henry Sturgeon Croson, M.D., F.A.C.S. St. Louis, C.V. Mosby Co. 1915.

² *THE GYNECOLOGY OF OBSTETRICS*. By David Hadjee, B.S., M.D. New York. The Macmillan Co. 1915.

a proof of obstetrics poorly done, and would the problem as a whole be solved even if it were possible to repair correctly all traumatism of parturition? Should not in this age and generation of prophylaxis, the true watchword be *prevention*?

If only, instead of a few brief remarks on the value of prophylaxis, the descriptive skill of the author had been enlisted to preach to the profession how much might be done by proper preventive measures! For instance, an emphatic warning against the high and "floating" forceps would do more for the patient than the description of the operation which eventually will have to remedy the hasty and injudicious action of the obstetrician. The proper care of the abdominal walls in pregnancy, and puerperium would do more good than any of the appliances recommended for the correction of kidney ptosis.

We do not wish to belittle the good intentions of the author. Yet, the object of this department of SURGERY, GYNECOLOGY AND OBSTETRICS is that of a *critical* review, not merely an enumeration of the contents of new books, and while we are only too glad to acknowledge what, in our subjective opinion, seems good and valuable, the study of this particular book has failed to convince us that the author has made the most of his opportunities.

THE title of this book¹ which has just appeared in its second edition, explains its purpose. The two collaborators are well known as joint authors of a textbook on gynecology. By leaving out the physiology and management of normal pregnancy, labor, and puerperium, they have gained space for a more detailed discussion of all obstetric complications than is usually found in textbooks on obstetrics. One may, perhaps, argue the wisdom of thus divorcing normal from pathologic obstetrics, but, on the other hand, every promising attempt at equipping the obstetrician more fully for his task, should be welcomed. The book in hand offers every guarantee that it will accomplish this object. It speaks a direct and convincing language and with the help of three hundred and two excellent illustrations leaves the student at no time in doubt as to the proper course to pursue at any stage of the emergency he may encounter. A book which fits its reader for his work, does a great deal of good even beyond the immediate need, for it lays the foundations for a gynecologic prophylaxis in obstet-

rics such as we have discussed in the preceding review.

Another gratifying feature is the careful attention given to complications arising from quarters other than the genital sphere. One hundred and twenty two pages are devoted to the relations between pregnancy and disorders of the intestinal and urinary tracts, of the peritoneum, the gall-bladder and spleen, the skin, the ductless glands, the nervous system, the circulatory system, the respiratory tract, and acute infectious fevers. These nine chapters make very interesting reading and afford much information even to the advanced student. The prevalence of influenza in this country, to select this illustration, should remind us of the fact that it has been noted that children born under this condition are weak and often die early. In severe cases the uterus is likely to empty itself prematurely, and this especially in the pneumonic type. From observations made in Switzerland, where the number of births was 5,000 less than the average of the four years previous to an epidemic of influenza, it has been argued that this disease may be a cause of sterility.

In the question of consanguineous marriages, the authors are in accord with the most modern teaching that in the marriage of first cousins there is nothing that necessarily leads to a deterioration of health or to mental weakness in their offspring. Their authorities are Thomson and Ross while Rohleder, perhaps the foremost exponent of the subject, is not mentioned. The book follows rather closely national lines, and the literature considered is, in the main, taken from English sources. This is particularly evident in the discussion of scopolamine narcophine narcosis where the experiences of a British author are given while those of Krönig and Gauss are omitted.

Here and there we find expressions which sound foreign to our ears. The *malacosteon*, *i.e.*, osteomalacic pelvis, is one of these terms.

The pictures on pp. 672 to 675 will bear revision. In performing the Porro operation after caesarean section, the authors seem first to sew up the uterine incision before proceeding to the removal of the organ by supravaginal amputation—a time-consuming and superfluous nicety. Conversely, the picture on p. 600 indicates that after salpingo-oophorectomy the stump of the ligament is left raw and unprotected against formation of adhesions, apparently in order to save time.

Summing up, we may say that the book is very pleasing and that it will be read with profit by obstetricians, young and old.

¹ THE DIFFICULTIES AND EMERGENCIES OF OBSTETRIC PRACTICE By Conynck Benckery M.A. M.D. M.C. Caslab F.R.C.P. Lond. M.R.C.S. Eng. and Victor Bonney M.S. M.D. B.Sc. Lond. F.R.C.S. Eng. M.R.C.P. Lond. Second Edition Philadelphia: P. Blakiston, Son & Co. 1915.

Clinical Congress of Surgeons of North America

SIXTH ANNUAL SESSION

BOSTON

OCTOBER 25 TO 29, 1915

CLINICAL CONGRESS OF SURGEONS OF NORTH AMERICA

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THE CLINICAL CONGRESS OF SURGEONS IN BOSTON

FOLLOWING the plan successfully carried out at previous sessions of the Congress, arrangements have been made for a series of evening meetings during the Boston session, at which eminent surgeons will read and discuss papers dealing with surgical subjects of present-day interest. A tentative program of these evening sessions will be found on the following pages. It will be noted that this program provides for one meeting on Monday evening, while on Tuesday, Wednesday, and Thursday evenings there will be two meetings—one for the general surgical division, in the ballroom of the Copley-Plaza, the other for the division of surgical specialties, at the Boston Medical Library. These meetings will open promptly at 8 o'clock and adjourn not later than 10:30.

Many changes have been made in the clinical program as published in this department, and still further changes are to be made previous to the week of the session. It will be understood that the published program is a provisional one—the real program of the Congress being the

schedule of clinics and demonstrations posted each afternoon on the bulletin boards at headquarters, where the cases to be operated upon or demonstrated at the clinics will be given in detail.

The committee on arrangements has planned a complete showing of Boston's clinical facilities in every department of surgery, including gynecology, obstetrics, genito-urinary surgery, orthopedics, and surgery of the eye, ear, nose and throat. In addition there will be a series of demonstrations and lectures on borderline subjects given by a number of eminent Boston surgeons and internists.

LIMITED ATTENDANCE

As was originally announced, attendance at this session will be limited in number, following the precedent established at the London session of the Congress in July, 1914. A careful survey of the operating amphitheatres, lecture rooms, and laboratories of the several hospitals and medical schools in Boston, as to their capacity for accommodating visiting surgeons, has been made, and

based thereon the limit of attendance has been fixed at 1500. All members of the Congress have been notified of this plan and of the necessity for registering in advance.

At this date, 1400 registrations have been received at the office of the Secretary-General, and it is obvious that the required number of registrations will be reached in advance of the meeting. When 1500 registrations have been received no further cards will be issued. The popularity of these meetings has become so great that this plan of limiting the attendance and requiring advance registration, which proved so satisfactory at the London session, has been decided upon to prevent overcrowding. A formal receipt is mailed to each member upon receipt of the registration fee, which receipt is to be exchanged for a membership card upon presentation when registering at headquarters.

SPECIAL TICKETS

The use of special tickets at previous sessions has fully demonstrated the efficacy of this method of providing for the distribution of the visiting surgeons among the various clinics and demonstrations, and to prevent overcrowding, as tickets for any one clinic or demonstration are limited in number to the actual capacity of the room in which the clinic or demonstration is to be given. Special tickets will be issued at 8 o'clock each morning for the clinics and demonstrations to be held that day, the complete schedule of clinics and demonstrations having been posted on the bulletin board during the afternoon of the preceding day. A printed schedule of the clinics and demonstrations will be distributed at 8 o'clock each morning.

HEADQUARTERS

Headquarters will be established at the Copley Plaza, which is centrally located in the Back Bay district and from which any of the hospitals and medical schools can be reached in a few minutes. The hotel is located only a block and a half from the Back Bay and Huntington Avenue railroad stations.

The Congress headquarters will be on the ground floor of the hotel where there is ample space for the registration and ticket bureaus, bulletins, etc. The large ball room in which the evening meetings are to be held is also located on the ground floor.

To enable the visiting surgeons to find their way about the city, a directory of the hospitals will be issued for free distribution. This will contain explicit instructions for reaching any of

the hospitals or medical schools from headquarters.

Headquarters will be open on the afternoon of Saturday, October 23rd, and all day Sunday, October 24th, for the registration of members, and it is urged that members plan to arrive in Boston not later than Sunday evening, in order to complete preliminaries before the opening of the Congress on Monday morning. The clinical schedule for Monday will be posted on Saturday afternoon.

REGISTRATION FEE

The constitution of the Congress provides that a registration fee shall be required of each member attending an annual meeting. There are no annual dues. The registration fees provide the funds to meet the expense of preparing for and conducting the annual meetings so that no financial burden is imposed upon the members of the profession in the city entertaining the Congress.

HOTELS

The executive committee is informed that the Boston hotels are usually well filled at this season of the year, and would strongly urge members to make their hotel reservations at once. Other first class hotels in the vicinity of the Copley Plaza (the headquarters) are: The Lenox, Brunswick, and Victoria.

REDUCED RAILWAY FARES

On account of the Boston meeting, the railways in the eastern portions of the United States and Canada have granted certain reductions in fares in selling round trip tickets. In the eastern part of the United States the fare will be two cents per mile in each direction, going and returning via the same route only, and over which one-way tickets are regularly sold. This rate will be in effect in the territory covered by the railway lines in the New England Passenger Association, Trunk Lines Association, Southeastern Passenger Association and Central Passenger Association, which covers practically all of the states east of the Mississippi River. Members living in the Western Passenger Association territory, that is, west of Chicago and St. Louis, should purchase tickets to the above gateways and then repurchase a round trip ticket to Boston in order to avail themselves of the special reduced fares. In Canada practically the same rates prevail as far west as Port Arthur. Tickets will be sold from all points on October 22, 23 and 24 with a final return limit to reach one's original starting point on or before midnight of November 3.

PRELIMINARY PROGRAM OF EVENING MEETINGS

GENERAL SURGICAL DIVISION--In the Ballroom of the Copley-Plaza at 8 p m

Presidential Meeting, Monday, October 25th

Address of Welcome by FRID RALFS LUND, M D, Boston, Chairman of the Committee on Arrangements
 Presentation of President WILLIAM L. RODMAN and President-Elect RUPERT BLUF of the American Medical Association

JOHN B. MURPHY, M D, Chicago Address of retiring president
 Inauguration of President CHARLES H. MAYO, and Vice-Presidents HERBERT A. BRUCH and ROBERT L. DICKINSON
 Presidential address by CHARLES H. MAYO, M D, Rochester, Minnesota

Tuesday, October 26th

THOMAS B. HARTZELL, M D, Minneapolis The Dental Path, Its Importance as an Avenue of Infection
 E. H. SANFORD, M D, Rochester, Minnesota Studies in the Relationship of Amœbiasis to Pyorrhœa Alveolaris
 WESTON A. PRICE, M D, Cleveland Cinematographic film showing movement of bacteria and amœba
 M. L. RHEIN, M D, New York City Discussion
 GEORGE W. CRILE, M D, Cleveland Acidosis in Its Relation to Surgery
 Professor LAWRENCE J. HENDERSON, Boston The Nature of Acidosis
 JAMES S. STONE, M D, Boston. Discussion

Wednesday, October 27th

A. J. OCHSNER, M D, Chicago Intestinal Stasis and Its Accompanying So-called Toxæmia
 Discussion by JOHN G. CLARK, M D, Philadelphia, Professor WALTER CANNON, Boston, FRANK W. SMITHIES, M D, Chicago
 Symposium Plastic Bone Surgery (Illustrated by lantern)
 FRED H. ALBEE, M D, New York City
 HARRY M. SHERMAN, M D, San Francisco
 JOHN B. MURPHY, M D, Chicago
 CHARLES L. SCUDDER, M D, Boston

Thursday, October 28th

Symposium on Cancer Speakers to be announced
 Symposium on Military Surgery GEORGE W. CRILE, M D, HARVEY CUSHING, M D, ROBERT B. GREENOUGH, M D, EDWARD H. NICHOLS, M D, ROBERT B. O'GOOD, M D, and others

DIVISION OF SURGICAL SPECIALTIES

At the Boston Medical Library, 8 Fenway, at 8 p m

Tuesday, October 26th

WALTER R. PARKER, M D, Detroit Ophthalmological paper, subject to be announced
 Discussion by GEORGE S. DERBY, M D, Boston, and ALEXANDER QUACKENBOSCH, M D, Boston

Wednesday, October 27th

B. A. RANDALL, M D, Philadelphia Otological Localization, Peripheral and Intracranial
 Discussion by E. W. TAYLOR, M D, Boston, and D. HAROLD WALKER, M D, Boston.

Thursday, October 28th

J. L. GOODALE, M D, Boston The Administration of Vegetable Proteids in Hay Fever
 Discussion by FRANK W. HINKEL, M D, Buffalo, and WALTER F. CHAPPELL, M D, New York

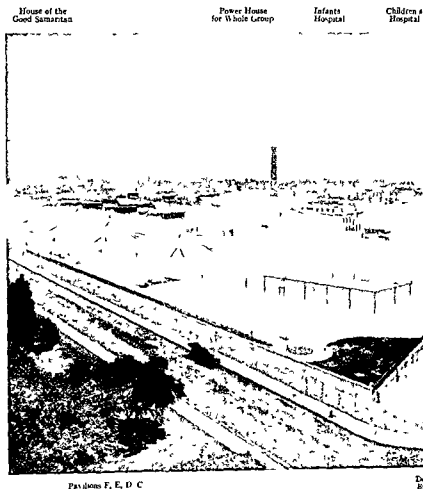
THE HOSPITALS AND MEDICAL SCHOOLS OF BOSTON

V—A GROUP OF BOSTON'S PUBLIC HOSPITALS

PETER BENT BRIGHAM HOSPITAL

The Peter Bent Brigham Hospital, built in 1913, on Huntington Avenue and Francis Street, adjacent to the Harvard Medical School, was founded by Peter Bent Brigham, who died in 1877. Its total cost was \$1,400,000 and it has an endowment of \$5,000,000. The purpose of its founder was that a hospital might be established "for the care of sick persons in indigent

circumstances residing in County of Suffolk." The hospital consists of five pavilions for patients and ten other buildings, so constructed as to be fire-proof throughout and so that each patient may be given the optimum amount of sunshine and fresh air with easy transport out of doors. It has 225 beds, half for medical cases and half for surgical. The type of cases are chiefly adult, non contagious, acute, or chronic with acute



Pavilions F, E, D, C

exacerbation, medical or surgical. The medical staff consists of a physician-in-chief, one physician, three associates in medicine, four resident physicians and eight medical house officers.

The surgical staff consists of a surgeon-in-chief, two surgeons, three associates in surgery, one supervisor of anesthesia, four resident surgeons and eight surgical house officers. The pathological department has one resident pathologist and a pathological interne. The administrative department consists of a superintendent and three assistant superintendents.

The relation of the hospital to the Harvard Medical School is close and friendly, but not integral, as shown by dual positions of the staff

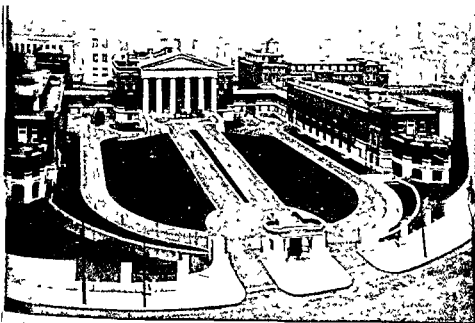
of the hospital, and the fact that students from Harvard Medical School are taught at the hospital. The management of the hospital, however, is by an independent board of trustees.

THE CHILDREN'S HOSPITAL

The Children's Hospital is situated on Longwood Avenue, adjacent to the Harvard Medical School, with which it is closely affiliated. The visiting staff of the hospital is appointed by the managers, but is nominated by the corporation of Harvard University. Furthermore, the visiting staff includes a bacteriologist, a chemist, a physiologist, a pharmacologist, and a pathologist,

Harvard Medical School

Collis P. Huntington
Memorial Hospital



Parlor
A

Administration Building

Entrance
Lodge

Outdoor Department
Nurses' Building (in Rear)

and Institutions in the Vicinity



Peter Bent Brigham Hospital, Typical Pavilion



Peter Bent Brigham Hospital Interior of Pavilion



Peter Bent Brigham Hospital, Respiration Laboratory

all of whom are appointed in the same manner as are the visiting physicians and surgeons. In this way the affiliation with the laboratory departments of the Harvard Medical School becomes very intimate and is of great advantage to the hospital.

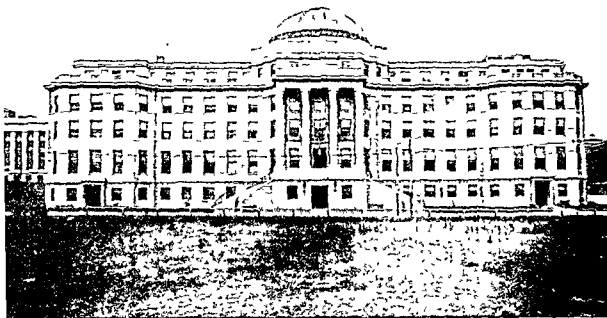
There are three main departments to the hospital: medical, surgical, and orthopaedic. As a subdivision of the orthopaedic department there is the scoliosis clinic, and in addition there is a throat department, which has beds in the hospital, a neurological department, a department of roentgenology, a department of physical therapeutics, and a special clinic for the treatment of paralytic cases. The social service is also one of the active departments, and there is of course a training school for nurses in connection with the hospital. A surgical appliance shop is also maintained for the purpose of supplying splints and apparatus to patients at cost.

The hospital moved from its old building on Huntington Avenue to its present quarters in the spring of 1914. The main building on Longwood Avenue is comprised of three parts, the Central Administration building, the Anne White Vose Nurses' Home on the east, and the Hunnewell building for out-patients on the west. The main building is fire proof throughout, five stories in height, and is built of a concrete conglomerate

of crushed trap rock, sand, and Portland cement having a natural gray color.

Great attention has been paid to the construction of the pavilion wards four in number. In planning them three points were kept constantly in mind: (1) ventilation, (2) out-door treatment, and (3) the control of contagious disease. It was considered that no system of artificial ventilation was satisfactory, that in order to secure really fresh air windows must be open, that the most satisfactory natural ventilation was secured by the passage of used air upward and out through openings at the top of the room. It was further thought essential that spaces of non-circulating dead air be eliminated. These two objects have been attained by wards with monitor tops and sloping ceilings.

In the two-story wards the monitor form is retained in both the upper and lower floor, and the ventilation in the lower story is not interfered with in the least by this arrangement, as the outer walls between the eaves of the lower story and the floor of the second story are merely open lattices between the necessary supporting columns. Thus the out-door air has free access to the windows in the monitor top. The balconies of the second floor, though wide, are so high above the windows of the first floor that they do not shut off the sunlight.



Children's Hospital, Main Building

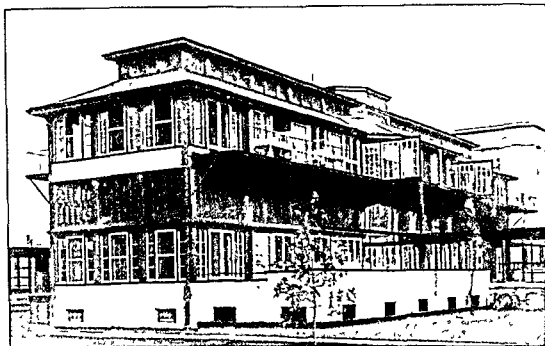
The problem of securing out-door treatment has been met by having wide windows on the southerly side of each ward extending to the floor and sliding back so that the beds may easily be pushed out on to broad piazzas.

The limitation of contagious disease is one of the problems constantly confronting the administrators of a children's hospital. It is important that the size of the open wards should be limited. Each half of each ward contains ten beds and one isolation room. These isolation rooms have proved of great value. Any patient presenting suspicious symptoms of contagious disease is at once transferred to this room for observation and for such future disposition as may seem best.

The operating rooms are in a special building. At one end is an amphitheater seating eighty three, with a separate entrance from the street for students. This amphitheater is planned rather for lectures and demonstrations than for ordinary

operations. Ordinarily all the operating is done in four small rooms, designed especially to give students a good view of what is being done. Low galleries at a height of about six feet above the floor are placed at the sides of the rooms. In each of these galleries six persons may sit, and at least six may stand and look over the shoulders of those sitting. Screens of plate glass placed at an angle in front of the seats prevent dirt from passing down on to the table or patient. Two of these rooms are used for clean operations, one for plaster-of-Paris work, and one for operations on septic cases.

In the year 1914 there were admitted to the hospital 2,534 ward patients, of whom 592 were medical, 810 surgical, 693 orthopaedic, and 439 throat patients. There were treated in the out-patient department 6,776 new patients, of whom 2,697 were medical, 1,358 surgical, 902 orthopaedic, 100 lateral curvature, 113 paralytic, 384 nerve, and 1,222 throat patients, while the whole num-



Children's Hospital Typical Ward Building

ber of visits made to the out-patient department amounted to 36,188, distributed as follows: medical 11,213, surgical 4,657, orthopaedic 5,878, lateral curvature 4,803, paralytic clinic 6,088, nerve 1,474, throat 2,075. There were 1,884 operations performed on house patients, 652 in the surgical service, 444 in the orthopaedic service, and 788 in the throat service.

COLLIS P. HUNTINGTON MEMORIAL HOSPITAL

The Collis P. Huntington Memorial Hospital located on the grounds of the Harvard Medical School is used for the clinical study of benign and malignant tumors by the Cancer Commission of Harvard University.

The hospital contains twenty five beds and is equipped with an X ray apparatus for diagnosis and treatment, laboratories for radium work, clinical laboratories operating room and examining rooms for out patients.

During the past year and at the present time the Cancer Commission is engaged in an investigation of the value of radium and X ray in the treatment of cancer and allied conditions.

ROBERT BENT BRIGHAM HOSPITAL

The Robert B. Brigham Hospital was built with funds left by Robert B. Brigham and his

sister, Miss Elizabeth B. Brigham. According to the will, the hospital was for the poor of Boston who were afflicted with chronic or incurable diseases.

The hospital has accommodations for 150 patients, and is fully equipped, expecting to receive the chronic patient with the idea of carrying on the most exhaustive study as to the nature of the difficulty and for treatment irrespective of the time required.

The staff is organized with a physician in chief, who is in charge of the medical service of the hospital. All cases are admitted to him and he is responsible for the cases during their stay in the hospital. He has as associates on the staff a surgeon, an orthopedist, a laboratory director who is a physiological chemist, and other specialists.

The hospital is fully equipped for the most difficult surgical and medical work, and careful physiological tests and chemical examinations are being carried on in the hope of finding the causes of the chronic disease condition, from which the proper treatment may be learned.

Naturally the patients remain in the hospital for long periods, there being no limit to the time, but the hospital is distinctly not a home, so that when the patient ceases to require medical treatment he is discharged.



Huntington Memorial Hospital

INFANTS' HOSPITAL

The Infants' Hospital was incorporated January 10, 1881, and for many years was on Blossom Street, in the West End of Boston. It was the first hospital in Boston to admit sick babies, and the first hospital in the country to restrict its patients to the first two years of life. The late Dr. Henry Cecil Haven was the founder, and soon after its establishment the late Dr. Thomas Morgan Rotch joined him in the work, and later took charge. Dr. Rotch was the inspiration for the beautiful new building on Van Dyke Street, near the Harvard Medical School, into which the hospital moved on March 3, 1914.

The activities of the hospital are as follows. The medical care of sick infants under two years of age. There are 65 beds, of which only 22 are now in use, owing to lack of funds. Patients are received from other hospitals and from physicians. There is no out patient department. The hospital maintains a special laboratory for the preparation of modified milk and other feeding mixtures.

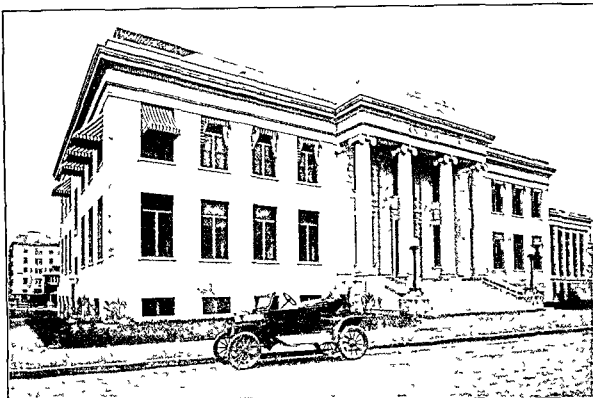
Research work is carried on in the hospital wards and in the Pathological Laboratory. Instruction is given to third and fourth year students of the Harvard Medical School, sections

being taught in the wards and in the Milk Laboratory. Summer courses are given for students registered in the Harvard Graduate School of Medicine. Internships with a three months' term are open to students and graduates.

Other activities include instruction to students from the Garland School of Homemaking, courses for mothers on the care of the baby and the modification of milk, a social service, babies being visited in their homes after discharge from the hospital, wet nurse directory, sending carefully tested wet nurses to all parts of New England, a four months' training in the care of infants for pupil and graduate nurses, a special training for nursery maids, comprising a six months' course in the hospital, after which they are qualified to take the entire charge of a well infant.

FREE HOSPITAL FOR WOMEN

The Free Hospital for Women is situated in Fenway Park on Park Avenue, a short distance from Brookline Village, and is devoted exclusively to the treatment of gynecological cases. The main hospital contains 67 beds for surgical patients. Connected with it is an out-patient



Infants' Hospital, Rotch Memorial Building

clinic which is open morning and afternoon every day excepting Saturday afternoon

The hospital is affiliated with the Harvard Medical School, the chief of staff being also professor of gynecology in that school. Undergraduates are given gynecological instruction in the wards and operating rooms, in the out patient clinics and in the pathological laboratory. Instruction is also given to a limited number of post-graduate students.

The hospital is literally a free institution, no charge being made for services of any kind, its support being derived from an endowment fund and from private contributions. Patients are received without distinction as to race or locality of residence.

CARNEY HOSPITAL

The Carney Hospital, an unwendowed institution, was opened on June 9, 1863, under the direction of the Sisters of Charity of St. Vincent de Paul, through the generosity of Andrew Carney of Boston. It is situated on the historic Dor-

chester Heights and commands a splendid view in every direction of Boston and its environs. Including general wards and private rooms it has about two hundred and fifty beds. Something over one-third of the patients pay nothing for the care they receive. There is also a large out-patient department.

It was the first hospital in New England to establish the continuous service of its staff members under a single chief, this was done in its surgical department in 1903. Dr. John C. Munro was the surgeon in chief. A little later the medical, gynecological and orthopedic departments were placed on a similar basis.

ST ELIZABETH'S HOSPITAL

St. Elizabeth's Hospital, founded in 1868, was formerly located on West Brookline Street in the south end of Boston and in its early days was devoted exclusively to the care of women. In 1912 the demand for larger accommodations became imperative and a beautiful site for the new hospital was purchased on Nevins' Hill, Brighton.

Here a modern hospital with the latest equipment was built and its doors opened to the first patient on September 1, 1914.

The present building has a frontage of 230 feet with an east and a west wing, each 75 feet long, the three sides forming a court-yard. The building is four stories in front and three at the back with verandas on the three sides of the court. This court has a southern exposure, shielded from the icy northern blasts in winter and cooled by the gentle southern breezes in the summer.

A second building, containing the convent and chapel, is now in process of construction. The nurses are at present housed in an old mansion in the vicinity of the hospital and a home for them is to be built as soon as the convent is completed. This first building has accommodations for 200 patients, about 125 beds being in open wards, the remainder in private and semi-private rooms. There is also a ward for children.

The hospital is a diocesan hospital under the management of a board of trustees, of which His Eminence, Cardinal O'Connell, Archbishop of Boston, is president. Acting under the board and in conjunction with it is a medical superintendent with Sisters of the Order of St. Francis at the head of the various departments.

Patients are received without regard to age, sex, creed, color or nationality. Those suffering from contagious, acute venereal or incurable diseases are not admitted.

All the services are continuous with the exception of the maternity, which has been found to work better as a rotating service. The various halls, five in number, are in charge of a Sister who is in every case a graduate nurse. The same is true of the operating suites, three in number. The training school connected with the hospital is under the supervision of a Sister, also a graduate nurse. The hospital has an out patient department with daily clinics for the poor, also a weekly pre-natal clinic. The X-ray department is equipped with the most modern apparatus. The hospital possesses a motor ambulance which on account of the location in the out skirts of the city is a most necessary adjunct for accidents and other emergency work.

The hospital is unendowed and is dependent for its support on the income derived from the private rooms together with the gifts of its many charitable friends.

NEW ENGLAND HOSPITAL FOR WOMEN AND CHILDREN

The hospital was incorporated March 12, 1863, the charter being granted to Marie Elizabeth

Zakrzewska, M.D., Lucy Goddard, and Ednah D. Cheney, the avowed objects of the institution being (1) to provide for women medical aid of competent physicians of their own sex; (2) to assist educated women in the practical study of medicine; (3) to train nurses for the care of the sick.

The actual beginning of the hospital work on July 1, 1862, was in a small house on Pleasant Street. These quarters were soon outgrown, and in 1864 the hospital was removed to an estate on Warrenton Street, running through to Pleasant Street, this gave much better opportunity for isolating maternity cases, and more room for the dispensary, and here for the first time the surgical department became of importance.

Owing to the growth of the city, the downtown neighborhood became more noisy and uncomfortable, and the management felt that the full success of the hospital required a building especially designed for its purposes. The proceeds of a fair were therefore devoted to the purchase of a site for a building, which was chosen on high land in the old town of Roxbury, now a part of Boston. Here a new three-story building for medical and surgical patients was erected and opened in June, 1872, maternity patients being placed in a separate building of more temporary character.

By the purchase of surrounding land the hospital now owns a tract of nine acres. The original building on this site, now named the Zakrzewska Building, in honor of the founder of the hospital, is at present used for medical wards, X-ray, electrotherapeutic work, hydrotherapy, and for administrative purposes.

The Sewall Maternity was erected in 1891, and has since been enlarged to 48 beds.

The Cheney Surgical Building was opened in 1900, the Goddard Home for Nurses in 1911, and the Kimball Cottage for Children, with its separate operating pavilion, the same year.

The hospital has now a capacity of 150 beds. Six women internes are appointed annually for a service of twelve months.

The dispensary has always remained in the heart of the city, its present quarters, the Pope Building, was erected in 1896 at 29 Fayette Street. There are medical, surgical and gynecological clinics, besides special clinics for eye, ear, nose and throat. Two of the internes are resident at the dispensary and attend medical and obstetrical patients in their own homes.

There is a Social Service Department connected with both hospital and dispensary.

Besides being unique in that it is the only



Free Hospital for Women

hospital in Boston where the staff is composed entirely of women, it has also the distinction of having opened a maternity department ten years prior to the founding of any other lying-in hospital in Boston. It also established the first training school for nurses in the United States.

One of the three avowed objects in founding the hospital was "to train nurses for the care of the sick." This was always kept in view from its origin in 1862. The experience of the Civil War did much to convince all classes of the importance of training for this profession as for every other. Before that time young women were averse to giving even six months to acquiring practical knowledge without pay. In 1872 the new building in Roxbury gave larger opportunities for the methodical organization of the training school, and the course was lengthened to one year with a definite schedule of lectures. The period of training has been extended from time to time. Since 1901 it has been three years.

The work done by the different departments of

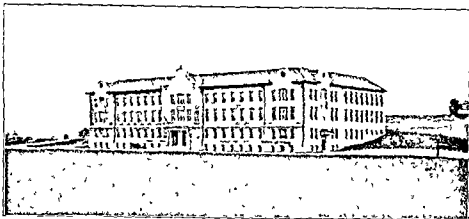
the hospital has steadily increased. Statistics from the last annual report give a total of 1,250 admissions to the hospital, medical, 386, surgical, 264, maternity, 600, 13,564 cases were treated at the dispensary clinics, besides 3,002 visits on patients at their homes.

The private corporation of the hospital receives neither state nor city aid, but does a large proportion of charitable work from its own funds.

UNITED STATES NAVAL HOSPITAL

The United States Naval Hospital at Chelsea was established in 1836. The present main building, occupied in 1915, conforms to the 'type' naval hospital plan, a design adapted with slight modification to subtropical stations as well as those in temperate zones.

The general arrangement of the main hospital resembles a "T," the central administration portion with the lateral wings forming the top, the sub-sistence and operating building, with con-



St. Elizabeth's Hospital

necting corridors and solaria, forming the vertical stem of the letter. The present capacity of the hospital is about 140 beds, and provision has been made for its extension to accommodate 400 beds should need arise.

The hospital is exclusively a naval institution, all connected with it being members of the naval organization, and all patients being officers or enlisted men of the navy. The work done is general in character being that naturally, entailed by the maintenance of a general hospital for men.

FORSYTH DENTAL INFIRMARY

The Forsyth Dental Infirmary for Children stands on the south side of the Back Bay Fens, near the Boston Art Museum. It is a handsome, new building, and aside from its practical utility, has a distinct value from an artistic point of view. The building is a memorial structure and therefore embodies many decorative features not usually found in purely hospital buildings.

The infirmary is an absolutely unique foundation. Small local dental clinics have existed in various parts of the world for some years, but this institution represents the first attempt on an adequate scale to care for the dental and oral needs of the children of a large urban population.

The building contains a large operating room in which there are 68 chairs, with room for more than 100, a boys' and a girls' ward, a museum and a research room, a room seating 200 persons in which popular lectures on oral and general hygiene are given, an operating theater, waiting rooms, children's room, etc. The sterilizing room contains ovens in which 60,000 instruments may be sterilized over night.

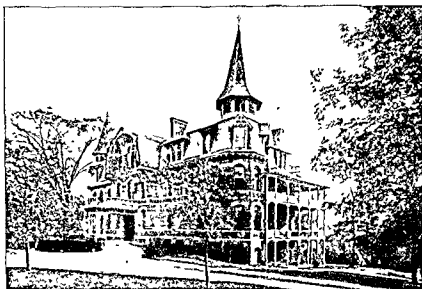
Every appointment of the building represents the last word in asepsis and efficiency. It is expected that the infirmary with its present equipments will care for 600 children per day. When the equipment is completed over 1,000 children per day can be accommodated.

ANGELL MEMORIAL HOSPITAL

The George T. Angell Memorial Hospital for animals, which was dedicated recently in Boston, is one of the best equipped institutions in the world for the care and treatment of animals. This new building, containing the business offices of the Massachusetts Society for the Prevention of Cruelty to Animals and the American Humane Education Society as well as spacious quarters for the medical and surgical treatment of animals, was started in the fall of 1913 and completed last spring. It is in every way thoroughly adapted to the purposes for which it was planned and constructed, and is in all respects a most fitting memorial to the life and labors of the great founder of the societies.

The building occupies 22,000 square feet of land situated in that section of the city that has already become famed for its hospitals, and educational and philanthropic institutions. The structure is fireproof throughout with concrete and tile floors, plaster block and brick partitions. The hospital proper is of two stories consisting two sides and the rear of the entire building and forming, with the front, a large open court which is protected by a glazed awning on three sides. The slate roof of the entire hospital affords ample exercise yards for small animals.

On the ground floor of the hospital there are operating rooms, medical surgical, and contagious



New England Hospital for Women and Children

wards, laboratory, tan-bark room, and garage. The operating-rooms and clinics have special metal window frames and sash to admit the most light possible and all wards have granolithic dado, five feet in height.

Many other features have been introduced into the hospital sections, including the latest type of tilting table for horse operations, and soak stalls supplied with hot and cold water passed through anti-scalding mixing valves.

The upper floor contains wards for the accommodation of smaller animals, a "small pet" department, hay and grain room, and superintendent's apartments.

The administration and editorial offices are located on the second floor of the main building, fronting on Longwood Avenue. Here also are the consulting-rooms, the library and memorial room, where are to be kept portraits of benefactors, tablets bearing their names and cabinets containing the names of every contributor to the fund for erecting and maintaining the building. The first floor contains the hospital offices and rooms for prosecuting agents and veterinarians.

With the single exception of the memorial room, in which are marble pilasters and marble floor, the interior is finished in wood, with no attempt at decoration. Indeed, the building throughout is entirely without "frills." Whether

one views it from without or within, the impression is at once striking that this hospital and all its appointments were planned and carried out with an eye single to permanence and serviceability.

Since the opening of its doors to the admission of patients on March 1, 1915, the hospital shows a steady increase from week to week both in the number of in-patients and out patients. The official figures for the first five weeks, which President Rowley states as "far exceeding our anticipations," were: Free dispensary cases treated, 294, hospital cases, 156, of which 91 required surgical operations. The statement for the month of April is as follows: Dispensary cases, 296, hospital cases, 120. The total number of animals treated for the first two months is reported as 767. To the uninformed and to those who were skeptical as to the benefits which would be derived for animals from the establishment of such an institution, this figure will be a surprise, it is indeed little short of a revelation.

The veterinary staff at the hospital have had notable success in their work on many animals since the hospital was opened. Numerous surgical operations have been performed upon subjects commonly regarded as passed the stage of curability and timely relief has been extended in scores of cases which, if unattended, could have resulted only in the most serious consequences.

PRELIMINARY CLINICAL PROGRAM FOR BOSTON MEETING

MASSACHUSETTS GENERAL HOSPITAL

Monday

- C A. PORTER—9 Operations Gout, cancer of stomach
 D F JONES—9 Operations Cancer of rectum (first stage)
 R C CABOT, HUGH CABOT, and OSCAR RICHARDSON—10 Demonstration Comparison of clinical evidence with post mortem findings
 HUGH CABOT et al—2 Operations Epididymectomy for tuberculosis, litholapaxy for stone in bladder, ureterotomy for stone
 C L SCUDDER—3 Demonstration Fractures
 HUGH WILLIAMS—3 Demonstration Cases

Tuesday

- E G BRACKETT and R B OSGOOD—9 Operations Excision of knee, with bone plates, exploration of knee joint through median incision.
 D L FOSSALL—10 Clinic Border line cases
 C L SCUDDER and H F HEWES—10 Demonstration Diagnosis and treatment of chronic gastric ulcer
 G W W BREWSTER—2 Operations Hysterectomy for fibroids, appendectomy
 LINCOLN DAVIS—2 Operations Ureterotomy for stone, hysterectomy
 ROGER I LEE and BETH VINCENT—2 Demonstration Splenectomy for pernicious anemia
 C C SIMMONS—3 Demonstration Osteomyelitis
 G A LELAND, JR—3 Demonstration Anthrax

Wednesday

- F G BALCH—9 Operations Prostatectomy, abdominal tumor
 R B GREENOUGH—9 Operations Benign tumor of breast, cancer of breast
 Z B ADAMS, M S DANFORTH, and C H BUCHOLZ—10 Demonstration Scoliosis
 L T. BROWN—10 Demonstration Postural defects
 FARRAR COBB—2 Operations Hysterectomy for cancer (Wertheim)
 HUGH WILLIAMS—2 Operations Gall bladder
 R C CABOT, HUGH CABOT, and OSCAR RICHARDSON—3 Demonstration Comparison of clinical evidence with post mortem findings

Thursday

- HUGH CABOT et al—9 Operations Nephrectomy for tuberculosis, pyelotomy for stone, prostatectomy
 R C CABOT—10 Clinic Border line cases
 ABNER POST—10 Demonstration Congenital syphilis
 E G BRACKETT and R B OSGOOD—2 Operations Open operation on hip, gig saw osteotomy of knee joint
 C A PORTER, A K. STONE, H F HEWES and J B HARTWELL—3 Demonstration Tuberculous cervical adenitis
 W. J. MYNTER—3 Demonstration Fracture of the skull.

Friday

- C L SCUDDER—9 Operations Duodenal ulcer, cancer of stomach, fracture of femur
 R B GREENOUGH—9 Operations Cancer of jaw, tongue, or lip

- J C WARREN—10 Demonstrations Reminiscences of the discovery of ether
 C A PORTER—10 Demonstration Cases
 R H MILLER—10 Demonstration Tetanus
 C A PORTER—2 Operations Tuberculous cervical adenitis, operation on peripheral nerve
 D F JONES—2 Operations Cancer of rectum (second stage)

Surgical Specialties

- A COOLIDGE, J P CLARK, H P MOSHER, D C GREENE, W. F. KNOWLES, H A BARNES, C ROBBINS, and F. E. GARLAND—Eye, ear, nose, and throat clinics, daily
 G H WRIGHT—Demonstrations in oral surgery
 J L GOODALE—Demonstration The diagnosis and desensitizing of hay fever

BOSTON CITY HOSPITAL

Monday

- J B BLAKE W E FAULKNER, and D D SCANNELL—9 Operations Surgical
 E B YOUNG and N R MASON—9 Operations Gynecological
 DRS HOLMES, BORDEN, COFFIN, and assistants—10 Ear, nose and throat clinic
 H A LOTHROP F J COTTON, and L R G CRANDON—2 Operations Surgical
 G P SANBORN—3 Demonstration End results in the tuberculin treatment of lymphnodular tuberculosis
 F W WHITE, F B LUND, and R D LEONARD—4 Demonstration Diagnosis and treatment of ulcer and cancer of the stomach (medical, surgical, and X ray)

Tuesday

- F B LUND J C HUBBARD, and HORACE BINNEY—9 Operations Surgical
 E B YOUNG and N R MASON—9 Operations Gynecological
 DRS HOLMES BORDEN, COFFIN and assistants—10 Ear, nose and throat clinic
 PAUL THORNDIKE and assistants—2 Operations Genito urinary
 PAUL THORNDIKE—3 Demonstration Prostatectomy, renal calculus
 HORACE BINNEY—4 Demonstration Treatment of tumors of the bladder with the high frequency current

Wednesday

- E H NEUBOLS W C HOWE, and H B LODER—9 Operations Surgical
 E B YOUNG and N R MASON—9 Operations Gynecological
 DRS HOLMES BORDEN COFFIN, and assistants—10 Ear nose and throat clinic
 J B BLAKE W E FAULKNER, and D D SCANNELL—2 Operations Surgical
 J B BLAKE—3 Demonstration Splenectomy for Banti's disease
 A R KEMPTON—4 Demonstration Transfusion by the use of glass cylinders bone tumors resection of the stomach for sarcoma

Thursday

- H A LOTHROP, F J COTTON, and L R G CRANDON — 9 Operations Surgical
- E B YOUNG and N R MASON — 9 Operations Gynecological
- DRS HOLMES, BORDEN, COFFIN, and assistants — 10 Ear, nose and throat clinic
- F B LUND, J C HUBBARD, and HORACE BINNEY — 2 Operations Surgical
- F J COTTON — 3 Demonstration Artificial impactions in fracture of the hip, joint affections, separations of the lower epiphysis of the femur
- F B LUND — 4 Demonstration Results of operative treatment of fractures, particularly with Parham and Martin bands, congenital cystic kidney, results of operations for intestinal tuberculosis
- C R. C. BORDEY — 4 Demonstration Cancer of the esophagus, esophagoscopy
- J H CUNNINGHAM — 4 30 Demonstration Nephrectomy for acute unilateral hematogenous infections of the kidney
- F H LAJLEY — 5 Demonstration Cardiospasm, carcinoma of the jejunum, resection of the rectum with penneal anus

Friday

- PAUL THORNDIKE and assistants — 9 Operations Genito-urinary
- E B YOUNG and N R MASON — 9 Operations Gynecological
- DRS HOLMES, BORDEN, COFFIN, and assistants — 10 Ear, nose and throat clinic
- E H NICHOLS, W C HOWE, and H B LODER — 2 Operations Surgical
- E H NICHOLS — 3 Demonstration Results and methods of operating for osteomyelitis, cerebral surgery
- H A LOTHROP — 4 Demonstration A new operation on the frontal sinus
- J C HUBBARD — 5 Demonstration Sarcoma of the femur, excision of the transverse colon perforation of duodenal ulcer, transduodenal removal of a gall stone, rupture of the liver

In connection with the operative clinics, demonstration of special methods of anaesthesia — intratracheal, spinal, etc. — will be given, where possible, by J E BUTLER, F L RICHARDSON, and N N MORSE

CHILDREN'S HOSPITAL

Orthopedic Department

- R W LOVETT, A THORNDIKE, ROBERT SOUTTER, A EHRENFRIED A T LEGG, J W SEVER, and HENRY J FITZSIMMONS — Daily, 9 to 11 Orthopedic operations Reduction of congenital dislocation of the hip by various methods, and especially by a special machine, tendon transplantations, capsule reefing, etc., in infantile paralysis, the use of silk ligaments in infantile paralysis the operative correction of club foot, the Hibbs and Albee operations for tuberculosis of the spine, the operative treatment for spastic paralysis, operations for coxa vara, bone transplantations
- R. W LOVETT — Monday, 2 30 and 5 10 Demonstration The treatment of infantile paralysis by muscle training, with exhibition of patients The treatment of scoliosis by forcible jackets Application of jackets and demonstration of results

- ROBERT SOUTTER and A T LEGG — Monday, 3 15 Demonstration Exhibition of the results of the operative treatment of infantile paralysis
- E G MARTIN — Monday, 3 30 Demonstration An apparatus to determine the strength of muscles affected by infantile paralysis, with conclusions to be drawn from observations made by it
- J J THOMAS and J W SEVER — Monday, 4 Demonstration Obstetrical paralysis and fracture of the acromion process simulating it
- Monday, Tuesday, and Wednesday, 3 Demonstration Treatment of paralysis by muscle training
- A THORNDIKE — Monday, 4 30 Demonstration End-results in osteoplastic operation for spinal tuberculosis
- PERCY BROWN — Monday, 4 50 Demonstration Röntgen results in osteoplastic spinal operations
- Thursday, 4 Demonstration Result of roentgen investigation in cases of fibrous stenosis of the pylorus in children
- Daily, 10 to 4 Exhibition of roentgenograms, roentgen department
- ROBERT SOUTTER — Thursday, 3 Operation A new operation for flexion contraction of the thigh in infantile paralysis
- A T LEGG — Thursday, 3 30 Operation Transplantation of the origin of the pectoralis major muscle in paralysis of the shoulder
- A EHRENFRIED — Thursday, 2 30 Demonstration Multiple enchondroma
- H J FITZSIMMONS — Monday, Tuesday, and Wednesday, 3 Demonstration Treatment of scoliosis with methods in use cases and records
- Thursday, 4 20 Demonstration Apparatus for reduction of congenital hip dislocations
- PROFS ERNST, FOLIN, HUNT, CANNON, and WOLBACH, DRS STOVE and MORSE — Thursday, 4 30 Clinic Infantile paralysis
- Visit to orthopedic wards daily, 11 to 12 The new hospital buildings will be open to inspection by visitors daily, 9 to 10.

Surgical Department

- J S STONE, W E LADD, C G MIXTER, and T W HARMER — Daily, 11 to 1 Surgical operations Harelip, cleft palate empyema, hernia, cervical adenitis, webbed fingers, hypospadias, undescended testis, etc
- C G MIXTER — Tuesday, 2 30 Demonstration Imperfect and ectopic anus
- Wednesday, 2 30 Demonstration Tuberculous peritonitis, pyloric stenosis undescended testis
- W E LADD — Tuesday, 2 30 Demonstration Cervical adenitis
- Wednesday, 2 30 Demonstration Intussusception, harelip and cleft palate
- J S STONE, W E LADD, and J J THOMAS — Tuesday, 2 30 Demonstration Fractures in children, subperiosteal and epiphyseal, elbow joint fractures, Volkmann's ischæmic contractures
- J S STOVE — Wednesday, 2 30 Demonstration Some obscure abdominal conditions, empyema, harelip, and cleft palate, acute epiphyseal lesions
- T W HARMER — Wednesday, 2 30 Demonstration The treatment of birthmarks
- PROFS ERNST, FOLIN, HUNT, CANNON, WOLBACH, DRS LOVETT, STONE, and MORSE — Tuesday, 4 30 Clinic Cervical adenitis
- D CROSBY GREENE and F E GARLAND — Monday, Wednesday, and Friday, 3 Nose and throat clinic
- Visit to general surgical wards daily, 10 to 11

MASSACHUSETTS HOMOEOPATHIC HOSPITAL

Monday

- A. G. HOWARD and H. MOORE — 9 Orthopedic operations Bone grafting, tendon transplantation
- J. H. PAYNE and D. W. WELLS — 9 Eye operations Advancement, pulley stitch, advancement, modified Worth, ptosis, Tansley operations, trephining, glaucoma.
- DRS. RICE, HOUGHTON, and C. SMITH — 2 Operations Nose and throat
- W. F. WESSELHOFF and T. E. CHANDLER — 2 General surgical operations Gastric ulcer, ventral hernia, inguinal hernia, appendicitis, oesophageal diverticulum.

Tuesday

- J. E. BRIGGS and C. T. HOWARD — 9 General surgical operations Prostate, appendix, goiter, inguinal hernia
- G. A. SUFFA and A. W. HORN — 9 Eye operations Muscle tucking, advancement, modified Worth, cataract extraction, glaucoma.
- HORACE PACKARD and C. T. HOWARD — 2 General surgical operation Appendectomy, a simpler method of sealing the appendicular stump Demonstration cases Proctectomy, the choice of routes, the control of post-operative hemorrhage, illustrative operations, empyema, cases for demonstration enteroptosis, cholelithiasis
- DRS. RICE, HOUGHTON, and SMITH — 2 Operations Nose and throat

Wednesday

- DRS. RICE, HOUGHTON, JOHNSON, SMITH, and BUSH — 9 Operations Nose and throat
- GEORGE H. EARL and H. MOORE — 9 Orthopedic operations Congenital dislocation of the hip, bone grafting, tendon transplantation
- W. F. WESSELHOFF and R. C. WIGGIN — 2 General surgical operations Nephrolithiasis
- F. W. COLBURN — 2 Operations Ear

Thursday

- J. E. BRIGGS and C. CRANE — 9 General surgical operations Cancer of the breast, appendix, cholelithiasis, nephrolithiasis
- DRS. RICE, HOUGHTON, and C. SMITH — 9 Operations Nose and throat
- G. R. SOUTHWICK — 2 Gynecological operations Ovarian cystomata retrodisplacement of uterus, uterine fibromata, perineorrhaphy

Friday

- G. R. SOUTHWICK and D. G. WILCOX — 9 Gynecological operations
- DRS. A. S. BRIGGS, BOYD, LEE, SEDGELEY, SOUTHER, and THOMAS — 2 General surgical operations

Demonstrations

- W. H. WATTERS — Surgical pathology
- G. A. SUFFA — Ophthalmotrope
- Routine examination of antepartum cases — Wednesday, 10
- Social service clinic for post partum cases — Thursday, 2
- Daily clinics in twilight sleep
- Daily exhibition of new maternity building

PETER BLUNT BRIGHAM HOSPITAL

- HARVEY CUSHING — Daily. Clinics or demonstrations Surgery of the brain, pituitary body, spinal cord, peripheral nerves
- DAVID CHIEVER and JOHN HOMANS — Daily. Operations Surgical
- HENRY A. CHRISTIAN, CHANNING FROTHINGHAM, and others of the medical staff will cooperate in giving clinics or demonstrations on selected topics, such as the electrocardiogram, etc

FREE HOSPITAL FOR WOMEN

- DRS. GRAVES, PEMBERTON, WADSWORTH, HUTCHINS, and BAKER — Tuesday, Wednesday, and Thursday, 9 Operations Gynecological
- W. P. GRAVES — Tuesday, 2 30 Exhibit of drawings illustrating gynecological subjects
- DR. PEMBERTON — Wednesday, 2 30 Cystoscopic demonstration
- DR. HUTCHINS — Thursday, 2 30 Demonstrations Laboratory specimens

ST. ELIZABETH'S HOSPITAL

- DRS. LANE and STUPPLE — Monday and Thursday, 9 Operations
- DR. M. J. CROWN — Monday, Thursday, and Friday, 10 Ward visit
- Wednesday 9 Intravenous salvarsan injections
- DR. T. F. BRODERICK — Tuesday, 9 Orthopedic operations and clinic
- DR. A. L. CRUTE — Wednesday and Friday, 9 Operations Genito-urinary
- DRS. BRAINERD and HOLMES — Tuesday, 9 Nose and throat clinic
- DR. A. F. DOWNING — Monday and Friday, 11 Demonstrations Laboratory technique
- DR. P. F. BUTLER — Tuesday and Thursday, 10 Demonstration Radiography
- DRS. McDONALD and McADAMS — Wednesday, 10 Eye clinic

The history, diagnosis and indication for operation in each case will be discussed previous to operation by Dr. Crown of the medical service and Dr. Butler of the roentgenological department

ROBERT BRIGHAM HOSPITAL

- CHARLES F. PAINTER and LLOYD T. BROWN — Tuesday, 10 Operations Surgical
- EDWARD RICHARDSON and RICHARD MILLER — Thursday, 10 Operations Surgical
- DRS. SPEARE, LAWRENCE, BROWN, and PAINTER — Monday Wednesday, and Friday 3 Clinics Surgery of chronic diseases arthritis, intestinal tuberculosis, peritoneal adhesions, hemolytic diseases

NEW ENGLAND HOSPITAL FOR WOMEN AND CHILDREN

- MARY A. SMITH — Monday and Thursday, 10 Operations Gynecological
- ELIZABETH T. GRAY and LETITIA D. ADAMS — Monday, 2, Tuesday 10 Operations Gynecological
- EMMA B. CULBERTSON — Tuesday and Friday, 2 Operations Gynecological

FLORENCE DUCKERING and LETITIA D. ADAMS — Wednesday, 10, Thursday, 2 Operations Gynecological
 MARGARET NOYES — Wednesday, 2 Ear, nose, and throat clinic
 MAUDE CARVILL — Thursday, 2 Eye clinic
 ISABELLE D. KERR — Friday, 10 Ear, nose, and throat clinic

Scopolamine morphia anesthesia both with and without ether will be used during these clinics Statistics, covering six years' continuous use of this form of surgical anesthesia, on over 1,400 cases, are available

LONG ISLAND HOSPITAL

F. H. LAHEY — Monday, 2 Operations
 J. H. CUNNINGHAM — Tuesday and Wednesday 2 Operations
 ROBERT SOUTTER — Thursday and Friday, 2 Operations

CARNEY HOSPITAL

J. T. BOTTOMLEY and D. F. MAHONEY — Monday, Wednesday, and Friday, 9 Operations Surgical
 W. R. MACAUSLAND and A. R. MACAUSLAND — Monday, Wednesday, and Friday, 9 Operations Orthopedic
 F. W. JOHNSON and S. RUSMORE — Tuesday and Thursday, 9 Operations Gynecological

CODMAN HOSPITAL

Hospital will be open daily for inspection with exhibition of the End Result System From 3 to 5 each afternoon
 DR. EMORY A. CODMAN will explain in detail the important points of this system

HOUSE OF THE GOOD SAMARITAN

DRS. SOUTTER, LEGG, and SEVER — Monday, Wednesday, and Friday, 10 Clinics Infantile paralysis muscle transplantation, flattened condition of the head of the femur, obstetrical paralysis

TUFTS MEDICAL SCHOOL

A. W. GEORGE — Daily, 2 to 5 Demonstrations Radiology (at 43 Bay State Road)

MASSACHUSETTS CHARITABLE EYE AND EAR INFIRMARY

DRS. CROCKETT, MOSHER, and LEMERSON — Monday and Friday Ophthalmological clinic
 DRS. JACK, WALKER, POWERS, and BLODGETT — Tuesday Ophthalmological clinic
 DRS. HAMMOND, WHITE, and PALACE — Wednesday Ophthalmological clinic
 DRS. JACK, KNOWLES, TOBEN, and BOGAN — Thursday Ophthalmological clinic
 DRS. THOMPSON, MORSE, and assistants — Monday and Tuesday Ophthalmological clinics

DRS. HASKELL, SPAULDING, and assistants — Wednesday Ophthalmological clinics
 DRS. VERHOFF, DERBY, and assistants — Thursday and Friday Ophthalmological clinics

HUNTINGTON MEMORIAL HOSPITAL

R. B. GREENOUGH and WILLIAM DOANE — Tuesday and Friday, 3 Demonstration of cancer cases treated with radium and X ray

INFANTS' HOSPITAL

BETH VINCENT — Thursday, 10 Operations and demonstration of cases
 CHARLES HUNTER DUNNE — Thursday, 10 Clinical demonstration of infants' diseases having a surgical bearing

BOSTON DISPENSARY

H. M. CHASE and H. F. DAY — Surgical clinic.
 JOHN ADAMS — Orthopedic clinic
 HENRY J. PERRY and ARTHUR H. CROSBY — Genito-urinary clinic

IORSYTH DENTAL INFIRMARY

I. RED B. LUND — Monday, 9 Surgical operations
 HARRY H. GERMAIN — Tuesday, 9 Surgical operations
 HUGH CABOT — Wednesday, 9 Surgical operations
 HUGH WILLIAMS — Thursday, 9 Surgical operations
 WILLIAM E. CHENERY and LOUIS ARKIN — Daily, 10 Nose and throat clinic.
 L. M. S. MINER — Wednesday, 2 Oral surgery
 HARRY B. SHUMAN — Tuesday, 2 Oral surgery
 ALBERT L. MIDDLEBY — Monday, 2 Oral surgery
 DR. STROUT — Thursday, 2 Oral Surgery
 ALBERT KINLEY, JR. — Daily, 11 Radiography
 WILLIAM A. GORIE — Daily, 11 30 and 3 Extracting clinic
 WILLIAM Z. HILL — Daily, 10 and 4 Operative dental clinics
 FRANK A. DELABARRE — Daily, 9 Orthodontia clinic
 Research Laboratory will be open from 9 to 12 and 2 to 4 daily Exhibition of pathological and bacteriological specimens

HARVARD MEDICAL SCHOOL

PROFS. COUNCILMAN and MALLORY — Demonstration Pathology
 PROFS. CANNON and W. T. PORTER — Demonstration Physiology
 PROF. FOLIN — Demonstration Chemistry
 PROF. STRONG — Demonstration Tropical Medicine
 PROF. REID HENTY — Demonstration Pharmacology
 DRS. ORDWAY and TYZZER — Demonstration Cancer research
 JOHN WARREN — Demonstration Anatomy
 W. F. WHITNEY — Demonstration Warren anatomical museum
 J. T. FOWLS — Demonstration Embryology
 J. E. GOLDTHWAIT — Demonstration Visceroperiosis



Fig. 1. Posterior surface of the uterus, showing hemorrhagic infiltration of uterus and ovaries
(J. Whitridge Williams)

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PREMATURE SEPARATION OF THE NORMALLY IMPLANTED PLACENTA

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BY this term is understood the separation before the birth of the child of the normally implanted placenta at any time during the last three months of pregnancy. The latter limitation is necessary, as a similar accident may occur before the period of viability is reached, and is one of the important factors in the production of abortion.

The separation may be complete, or may involve only a limited area of the placenta, but in either event blood-vessels are torn through, and bleeding occurs, which is not checked until the uterus is emptied of its contents and is thereby enabled to contract down upon and to compress the bleeding vessels. Since the time of Rigby such hæmorrhage has been designated as accidental, in contradistinction to the unavoidable hæmorrhage which is associated with placenta prævia. According as the foetal membranes below the placenta become separated or not the blood escapes through the cervix and thence externally, or is effused between the uterine wall and the placenta and its membranes, and occasionally ruptures through the latter into the amniotic cavity. In the former event the hæmorrhage is external, and in the latter concealed, while in many instances the two varieties are combined, when only a fraction of the effused blood may escape from the vulva.

In this article I shall discuss the subject from two points of view, firstly, in the light of our knowledge up to 1911, and secondly, upon the basis of observations which have been made since that date. In the second section, I shall describe in detail two cases of concealed hæmorrhage which I have recently observed, and shall discuss their bearing upon the etiology, pathology, and treatment of the condition.

History. Hæmorrhage due to premature separation of the normally implanted placenta has doubtless occurred since time immemorial, but its significance has only recently been appreciated. According to Madame Henry, Louise Bourgeois first recognized the condition in 1609, while Baudelocque made a similar claim for Primrose in 1665. Isolated cases were described by Mauriceau, Puzos and other observers during the first half of the 18th century, but it was not until after the appearance in 1776 of Rigby's monograph—"An essay upon the uterine hæmorrhage which precedes the delivery of the full grown fœtus"—that its mode of production was clearly understood. This monograph, which went through five editions—the last appearing in 1811—exerted great influence throughout the English-speaking world. In it Rigby clearly differentiated between hæmorrhage due to premature separation of the placenta and that

due to placenta prævia, and designated the former as accidental and the latter as unavoidable.

I am unable to accept Holmes' contention that Rigby confused the two conditions, and I agree entirely with Essen-Møller that he is entitled to full credit for their differentiation, and I expect the unprejudiced reader to draw the same conclusion from Rigby's own words: "There is no particular part of the uterus to which Nature seems constantly and uniformly to fix the placenta, it is, nevertheless, for the most part, so situated that if the woman be healthy, and no accident befall her, it does not separate until the full time of pregnancy, nor then before the entire expulsion of the child, after which it becomes disengaged from the uterus and is thrown off, making room for its entire contraction, which, shutting up the mouths of the vessels, effectually prevents any considerable loss of blood, for which purpose it is plain it must be fixed to some part of the womb which does not dilate during labor, namely, to the fundus or sides of it. In this case, then, when a flooding comes on before delivery of the child, it is obvious that the separation of the placenta must be due to some accidental circumstance to violence done to the uterus by blows or falls or fever, or to some influence of the passions of the mind suddenly excited, such as fear, anger, etc. But from the uncertainty with which, as before observed, Nature fixes the placenta to the uterus, it may happen to be so situated, that when the full term of pregnancy is arrived and labor begins, a flooding necessarily accompanies it and without the intervention of any of the above accidental circumstances, that is, while it is fixed to that part of the womb which always dilates as labor advances namely, the *collum* and *os uteri* in which case it is very certain that the placenta can not, as before described, remain secure until the expulsion of the child but must of necessity be separated from it in proportion as the uterus opens and by that means an hæmorrhage must unavoidably be produced."

Similar views were expressed by Denman in 1786 in his "Essay on Uterine Hæmorrhage Depending upon Pregnancy and Parturition."

In speaking of bleeding in the last three months of pregnancy, he stated: "These hæmorrhages are occasioned first by the attachment of the placenta over the *os uteri*; second, by a separation of a part or of the whole placenta which had been attached to any other part of the uterus, etc."

It is also claimed that Burns differentiated the two conditions in his monograph, which appeared in 1807, but, while he had doubtless encountered examples of both, his descriptions lacked the lucidity of those of his predecessors.

Popular interest in this type of hæmorrhage was greatly stimulated by the death in her first confinement of the Princess Charlotte, the only child of George IV, in 1817, and led to numerous casuistic reports. It was also the direct incentive to the preparation of Césaire Baudelocque's "*Traité des hémorrhagies internes de l'utérus*," which appeared in 1831. This monograph, which was prepared in collaboration with Deneux, was an amplification of an essay which was read before the Société de Médecine de Paris in 1819 and which received the prize offered by Dr. Bousquet just after Princess Charlotte's death. In this verbose production were collected all varieties of hæmorrhage some of which were undoubtedly due to premature separation of the placenta—notably the report of the post-mortem cesarean section performed by de laFortrie, in which the completely separated placenta was found loose in the uterine cavity.

Notwithstanding the accumulation of evidence certain obstetricians still remained skeptical of the possibility of such an occurrence and Mesdames La Chapelle and Boivin were among the number.

Thirty years passed before another important contribution was made when Braxton Hicks described a case of concealed hæmorrhage before the London Obstetrical Society in 1861 and collected 22 other cases from the literature. He described the symptomatology and diagnosis with great accuracy and laid down a course of treatment in accordance with the views then in vogue.

Probably the most important article upon the subject was written by Goodell in 1870.

will be described later, occurred in private practice. The extent of the separation varied greatly. In Case 2, the placenta lay free in the uterine cavity; in another instance one-half of the placental surface was separated, while in the majority of cases the separation involved areas which varied from 3 by 5 to 5 by 10 cm in dimension.

Etiology. Up to 1885, when Winter directed attention to the frequent association of nephritis with premature separation of the placenta, the etiological factors most usually invoked were trauma, short umbilical cord, and profound mental emotions. It is interesting to note that in the classical specimen, which is figured in the Atlas of Pinard and Varnier, the accident was attributed to traction upon the placenta by a relatively short cord. From the time of Winter, however, the presence of albumin in the urine has been demonstrated in a considerable proportion of cases, although no clear explanation has been adduced as to its mode of action. Hofmeier considered that nephritis was the cause par excellence, and the accompanying figures indicate the frequency with which albuminuria was noted by the several writers.

Gaston	in 30 out of 70 cases
Bar and Kervily	in 33 out of 58 cases
Dorman	in 82 out of 158 cases
Essen Moller	in 11 out of 29 cases

Furthermore, the fact that Seitz, Bar and Kervily, Couvelaire, Zarate, and others observed the accident in women suffering from eclampsia, clearly indicates that in certain cases, at least, there must be some definite connection between it and the toxæmic process. Indeed Bar goes so far as to assume that most of the serious cases are associated with the condition which he has designated as "eclampsisme"—namely, eclampsia without convulsions—and states that it could as readily be held responsible for the retroplacental hæmorrhage as for cerebral apoplexy.

Aschner, who states that albuminuria was observed before labor in 15 per cent of the patients in the Halle clinic, investigated the question by means of Abderhalden's method, and concluded that the albumin was of placental rather than of renal origin. Con-

sequently, he held that such patients were suffering from the "kidney of pregnancy" rather than from nephritis.

Albuminuria was present in 11 and absent from 4 of my 17 patients. Closer investigation, however, deprives the figures of a large part of their significance; as albumin in considerable quantity was present both before and after labor in only two instances. In the other patients it was only present in traces in uncatheterized urine immediately following delivery and promptly disappeared. Consequently, I am forced to conclude that in my cases, at least, the usual forms of toxæmia of pregnancy and nephritis play an inconsiderable, if any, part in the production of the accident. Furthermore, Barchet states that albuminuria was absent in all cases observed in Tübingen, and Guerard holds that it is present only in a small proportion of patients.

While trauma and traction by an absolutely or relatively short umbilical cord may be etiological factors in occasional instances, I am inclined to agree with Zweifel and most recent writers that their importance has been greatly overestimated.

Following nephritis and trauma, most writers consider endometritis and inflammatory and degenerative lesions in the uterine wall as important causative factors, and they are given great prominence in all statistical reports. On the other hand, when the literature is searched for evidence in support of such statements the result is surprisingly meager. Thus, Weiss in 1894 reported finding small cell infiltration in the decidua and muscularis in several of his cases. Seitz stated that similar conditions obtained in one of his specimens, but were absent from another. Schickel, in addition, described degenerative changes in the decidua which he assumed were connected with the nephritic process and played a part in bringing about the placental separation. But with these exceptions, I have been unable to find positive statements in this regard, and none of the authors have claimed that the lesions were universally present.

On the other hand, in the two specimens which form the basis for this paper, inflam-

matory lesions were not present either in the decidua or muscularis. Moreover, I have examined with the same result microscopic sections, which extended through the entire area of separation, in a number of prematurely separated placentæ. Consequently, I hold that endometritis plays no part in the production of the accident, and that when areas of small cell infiltration are occasionally found in the decidua, the lesion must be regarded as an accidental complication.

As the result of my investigations and study I am prepared to admit that trauma may occasionally be a causative factor, that I know nothing of the effect of mental emotions, that endometritis, when present, is merely an accidental complication, but that there probably exists some indirect connection between the toxæmic processes and the accident in question.

Symptomatology and diagnosis. Very little need be said under this heading, as this aspect of the subject is well and thoroughly treated in most current textbooks.

I would, however, insist upon the importance of realizing that, while completely concealed hæmorrhage is a very rare complication, antepartum hæmorrhage due to premature separation of the normally implanted placenta is quite as frequent as that due to placenta prævia, and should be diagnosed whenever the finger introduced past the internal os fails to feel placental tissue. Likewise, that the amount of external hæmorrhage is not necessarily an accurate index of either the degree of separation nor of the quantity of blood lost.

I would furthermore direct attention to the diagnostic significance of the change in the consistency of the uterus, as it has been my experience that whenever that organ presents a ligneous consistency in the latter part of pregnancy or early in labor, and does not alternate between contraction and relaxation, the diagnosis is practically assured. This sign does not depend upon the actual amount of blood lost, and is equally significant whether the hæmorrhage is concealed or external. In the former event, valuable information as to the amount of blood lost may also be obtained by changes in the hæmo-

globin content before the pulse gives any indication of the existence of shock.

DESCRIPTION OF CASES AND SPECIMENS

CASE 1. Mrs. E. H. B., private patient, November 27, 1914. A 24 year old nullipara with a normal pelvis. Her previous history was unimportant except for an operation for gonorrhea two years previously. Last period April 17, 1914. Up to the present illness, the pregnancy was perfectly normal, and repeated examination of the urine had shown the absence of albumin and casts.

Without previous warning the patient was seized in the early morning with intense abdominal pain, which she at first attributed to indigestion. When I saw her at 9.30 a.m., she was rolling about the bed and complaining of intense and constant pain. On palpation the uterus was unusually hard and tense, and did not alternate between contraction and relaxation, the fundus was three fingers below the xiphoid. The round ligaments stood out like whip cords. The small child apparently lay in L. O. A. but heart sounds could not be detected. On vaginal examination there were no signs of beginning labor, and the cervix was hard and undilated. No vaginal discharge or hæmorrhage. Notwithstanding a pulse rate of 80 and the absence of shock and pallor, I instinctively suspected the possibility of concealed hæmorrhage due to premature separation of the placenta, and, after giving a hypodermic of morphia, sent the patient to the hospital for observation.

Upon admission at 11.30 a.m., the hæmoglobin content was found to be 55 per cent, but the general condition had slightly improved, probably as the result of the morphia. At 2 p.m. the patient looked palid and sicker than before. The pulse was unchanged, but the hæmoglobin had fallen to 35 per cent, and the uterus was ligneous in consistency and apparently slightly larger than in the morning. There was still no external bleeding. A positive diagnosis of concealed hæmorrhage was then made, and in view of the undilated condition of the cervix it was determined that the most conservative method of delivery would be by cesarean section.

The usual preparations were made, and by the time the patient was ready for operation the pulse had risen to 160. Following the administration of two barrels of ergotol, the abdomen was opened in the midline. Upon incising the uterus, a stream of clear amniotic fluid escaped under great pressure, and for a moment led me to fear that I had made a mistake in diagnosis. The freshly dead seven months child was extracted by the feet and immediately thereafter the completely detached placenta came into the uterine wound, and upon removing it a large amount of fluid and coagulated blood escaped, which I estimated at 1½ to 2 litres.

The uterus was then eviscerated and was found to present a very striking appearance, the whole right side being dark purplish red in color, and

resembled an ovarian tumor with a twisted pedicle. The median end of the right broad ligament was considerably swollen and presented a similar appearance, which also involved the lateral two thirds of the tube. The ovary appeared to be normal, and the corpus luteum was situated on the opposite side. Following its evacuation, the uterus showed no tendency to contract and had the consistency of a piece of moist leather. There was, however, comparatively little hemorrhage.

In view of the fact that the patient was a primipara, I hesitated about removing the organ and gave 2 ccm of pituitrin hypodermatically and attempted to stimulate contractions by means of external hot applications and by rubbing its interior with iodoform gauze. As this was without effect, I reluctantly decided to remove the uterus. It was amputated without difficulty at the level of the internal os, the tubes and ovaries being left *in situ*. After covering the stump with peritoneum, the abdominal wound was closed in three layers.

At the completion of the operation the patient was less shocked than might have been expected, but during the following days she improved less rapidly than was anticipated, the pulse remaining high and the pallor continuing, notwithstanding the fact that she received large amounts of saline per rectum and took food readily. On the evening of the fifth day the pulse became weaker and more rapid, and the pallor increased, the hemoglobin remaining at 35 per cent. As there were no signs of hemorrhage it was felt that the blood-making function was in abeyance and that transfusion might be of benefit. Accordingly after the usual hemolytic tests she was infused directly from her brother. This was followed by a slight temporary rise in blood pressure and a brightening of the mucous membranes and face, but twelve hours later the patient's condition was essentially the same so that it was doubtful whether she derived any benefit from the transfusion. She gradually improved, however, and left the hospital three weeks after the operation with a hemoglobin percentage of 85 and the pulse in the neighborhood of 120. Three weeks later I saw the patient at her home and found her greatly improved but somewhat pallid, while the pulse was still rapid so that the question arose as to whether the tachycardia should not be attributed to hyperthyroidism.

Description of specimen. The uterus and placenta were placed in formalin immediately after the operation and when examined the next day presented the following appearance. Placenta 18 x 15 x 2 cm in its various diameters, no white or red infarcts; maternal and fetal surfaces normal except for a pronounced marginate. No coagulated blood was adherent to its maternal surface to interfere with premature separation.

The uterus, which was unusually flabby, measured 15 x 12 x 5 cm in its various diameters, with a large cut surface corresponding to the lower uterine seg-

ment and an incision in the center of its anterior wall. Its posterior surface and both margins, but particularly the right, presented a bluish, purplish coloration apparently due to the effusion of blood. A horizontal section was then cut just beneath the insertion of the tubes, when it was found that the placental site occupied the posterior wall, which measured 2 cm and the anterior wall 1.75 cm in thickness. The most striking feature was that three quarters of the section presented a bluish, purplish appearance, due to the extravasation of blood between the muscle fibers. This was most marked on the right side, but the only portion which was free from it was the left half of the anterior wall. Figs. 1 and 2, give an excellent idea of the contrast between the conditions present in the specimen and in a normal puerperal uterus.

Microscopic sections through the placenta showed perfectly normal conditions, although the villi were slightly larger than usual, and had a very cellular stroma. There were no changes suggestive of syphilis; the maternal surface was normal except for a number of small hemorrhagic areas in the decidua and showed no sign of leucocytic infiltration.

Sections through the uterine wall at various levels presented practically identical conditions. The remnants of the decidua vera were normal and showed no trace of inflammation. At the placental site there was an unusual amount of fibrin and just beneath the decidua basalis large quantities of blood lay free between the muscle fibers. In all sections the most striking feature was the existence of profuse hemorrhage throughout the musculature, particularly in the posterior wall and right margin. In places the blood had entirely disassociated the muscle fibers thereby explaining why the organ had failed to contract at the time of operation (Fig. 4).

The large veins were uniformly empty but in the walls of many free hemorrhage had occurred, just beneath the endothelium and communicated freely with the hemorrhagic effusions between the muscle fibers. Many of the smaller veins were filled by fresh thrombi. The arteries were in great part normal but a number presented peculiar degenerative changes. In some of the smaller ones the intima was swollen in places and projected into the lumen and was conspicuous on account of the diffuse blue staining which it assumed. In such cases the inner architecture of the vessel wall was disturbed and peculiar defects were seen which appeared as clear circular or elliptical zones while in other places irregular blue granules were found which stained very intensely with hematoxylin. Throughout these areas much fragmentation and atypical arrangement of the cells was observed (Fig. 5). In several places defects were present in the intima of the larger arteries which may have been connected with the hemorrhagic areas in their intima. After finishing these arterial changes, the entire right half of the uterus was cut into serial sections for the purpose of determining whether

similar lesions existed in the main branches of the uterine artery, but the results were negative. Specimens stained by Weigert's method showed no increase in the amount of elastic tissue.

Diagnosis. Premature separation of the normally implanted placenta, concealed hemorrhage, hemorrhagic infarction of the uterus, degenerative arterial changes.

CASE 2. A F, No 7,190. The eighteen year nulliparous patient was seen in the dispensary April 13, 1915, when examination showed that she was nine months pregnant, child in R O A, pelvis normal. There was some edema of the feet and a definite amount of albumin in the urine, but no other signs of toxæmia, blood pressure 120. On three other occasions during the following two weeks the urine was examined but was found negative.

On May 4, the patient was brought to the hospital in the ambulance, and gave the following history. Labor pains had begun the evening before and at about 6 a.m. a gush of blood had occurred from the vagina. She was seen by the out patient department about noon and was brought at once to the hospital. On admission at 1:20 p.m. a considerable amount of dark red blood was escaping from the vagina. The patient was extremely pale, pulse 128, blood pressure 100, temperature normal, and hæmoglobin 32 per cent. The uterus reached to within two fingers' breadth of the xiphoid and was so hard and boardlike that the child could not be palpated, although the head seemed to be engaged. Fœtal heart sounds could not be heard. On vaginal examination the outlet was nulliparous, external os admitted one finger, cervical canal intact, placental tissue not felt.

In view of the shock, which was out of proportion to the amount of blood lost, the consistency of the uterus, and the absence of placenta prævia the Resident Obstetrician made a diagnosis of premature separation of placenta with concealed and external hemorrhage and notified me. I decided that cesarean section would be the most conservative method of delivery and operated as soon as the necessary preparations were completed. When abdomen was opened, its cavity was found to contain a quantity of clear serous fluid. Upon incising the uterus a stream of immiscible fluid escaped with considerable force. The dead child which presented in R O T, was extracted by the feet. Immediately following its delivery the placenta appeared in the wound, and as it was extracted a large amount of partially clotted blood escaped with it. Notwithstanding the fact that considerable quantities were lost, 900 ccm. were collected and measured.

Upon viscerating the uterus it was found that it showed no tendency to contract and presented the consistency of a wet leathery sac, notwithstanding the administration of 1 cm. of pituitrin and a barrel of ergotol at the beginning of the operation. The upper part of the body of the uterus presented a peculiar purplish bluish coppery appearance similar to that observed in Case 1, the right tube

and ovary were reddish black in color and suggested the conditions observed in an ovarian cyst with a twisted pedicle. The right broad ligament was distended by blood and formed a hematoma of considerable size, while the left tube and ovary were normal. As the uterus did not contract in spite of energetic massage, supravaginal hysterectomy was done, the right appendages being removed and the left retained *in situ*. The amputation was done through the lower part of the lower segment and the stump covered with peritoneum in the usual manner. As we were particularly impressed by the size of the ovarian vessels, a separate ligature was placed on each of the main vessels in addition to the original ligature. The abdominal wall was closed in four layers. Very little blood was lost and the patient was returned to bed in approximately as good condition as before the operation. A subcutaneous mammary infusion was started while she was still on the table. The child was slightly macerated, weighed 3,190 grams, and measured 52 cm. in length.

When the patient was returned to bed, coffee and salt solution were given per rectum, and her condition seemed quite satisfactory. Three hours later, however, the vulval pads were tinged with blood and the pulse had risen to 142. The vagina was accordingly packed with gauze and no further bleeding occurred. The patient's condition continued serious throughout the night but had considerably improved the next morning, when the pulse was 130, blood pressure 135 and hæmoglobin 16 per cent. The improvement continued, and by the fourth day the pulse had fallen to 100.

Following this there was some elevation of temperature, and a mass slowly developed in the right lower quadrant of the abdomen. Blood cultures were negative. By June 1 a definite tumor had formed which filled out the right lower abdomen and extended to the left of the midline, while on vaginal examination a fluctuant mass was felt in the right broad ligament and bulged behind the cervix. The vaginal mass was punctured and the abdominal tumor opened extraperitoneally by an incision above and parallel to Poupart's ligament when a large quantity of greenish pus escaped. The wounds were packed with gauze and the necessary sutures introduced. Bacteriological examination showed a pyogenic and an unidentified Gram positive bacillus. Following the operation the patient improved rapidly and at the end of a month was discharged in excellent condition with a hæmoglobin content of 60 per cent.

A catheterized specimen of urine obtained at the time of the cesarean section contained 4 grams of albumen per litre and numerous granular casts. This rapidly diminished but traces were still present at the time of a subsequent micturition. It is probable that the patient is suffering from chronic nephritis.

Description of specimen. The placenta measured 21 x 14 x 5 cm. presented a few small white infarcts on its fetal but none on its maternal surface.

Microscopic sections showed normal conditions. The decidua basalis contained many chorionic cells but showed no sign of inflammation. In places the decidual cells were pushed apart by small collections of blood, which probably played a part in bringing about the separation.

Immediately after the operation, a water color sketch of the specimen was prepared under the supervision of Mr. M. H. Broedel, and shows very clearly the striking appearance of the uterus and its appendages (Fig. 3, see frontispiece). The uterus was unusually large and flabby, and measured $19 \times 14 \times 5.5$ cm in its various diameters. Except for the lower two thirds of the fundus of both the anterior and posterior walls, its exterior presented a peculiar mottled bluish, purplish, coppery appearance with many distended venous vessels. The non affected central portion presented the characteristic appearance of a normal fresh puerperal uterus. The placental site was on the posterior wall.

The tube measured $13 \times 3 \times 0.5$ cm. The fimbriated end was free, but was bluish black in color, suggesting infiltration with blood. The ovary measured $4.5 \times 2 \times 1.5$ cm in its various diameters, it was free from adhesions but presented a generally apoplectic appearance as in a case of twisted pedicle. No follicles were visible on its exterior.

Sections for microscopic examination were cut through various portions of the uterine wall as well as from the tube and ovary. Thus, from the anterior wall just below the fundus showed that the hemorrhage was in great part limited to the outer half of the organ. Here it had spread apart the individual muscle fibers and bands just as in Case 1, and in places was associated with very considerable edema. Apparently it was not connected with the larger vessels, which in many places had been dissected out by the hemorrhage. Sections through the placental site show similar hemorrhagic changes in the muscle wall, but the decidua and serotina were perfectly normal except for small hemorrhagic areas and showed no sign of inflammatory change. In this region many of the larger veins were almost completely filled by large thrombi, which were made up of platelets and leucocytes, but contained very little fibrin. Many of the smaller veins were almost occluded by white thrombi of the same character. The large arteries were normal, but certain of the smaller ones presented changes in the intima similar to those observed in Case 1. The endothelium was unchanged, but the tissue beneath it was increased in thickness, took on a peculiar bluish color with hematoxylin and suggested a mucoid change. Here and there it contained peculiarly shaped refractile bodies similar to those described in Case 1. Sections from the various portions of the main uterine and ovarian vessels showed normal conditions.

Sections through the tube showed a normal mucosa. In its lateral portion the muscle fibers were widely spread apart by hemorrhage. Sections

through the ovary showed numerous primordial, but very few maturing follicles. Free hemorrhage had occurred throughout the stroma of the organ, widely separating its component parts. In places primordial follicles lay apparently free in the midst of hemorrhagic areas, and many of the larger vessels were completely isolated. The vessels themselves were normal.

Diagnosis. Premature separation of the normally implanted placenta, with combined concealed and external hemorrhage. Hemorrhagic infarction of the uterus, right tube, and ovary. Extensive thrombosis, peculiar degenerative arterial changes.

DISCUSSION OF CASES AND SPECIMENS

When I had completed the histological study of my first specimen I thought that I had made a unique observation, but, upon looking through the literature I discovered that such was not the case, and that similar conditions had already been described.

In 1911 Couvelaire reported to the Obstetrical Society of France the history of an albuminuric patient upon whom he had performed caesarean section on account of premature separation of the placenta. After emptying the uterus he was surprised by its peculiar appearance, which resembled that of an ovarian tumor with a twisted pedicle, and, as the uterus failed to contract, he removed it by supravaginal amputation. Macroscopically, the specimen was identical with those which I have just described, and the drawings showed that the histological lesions were of the same character, except that vascular changes were absent. He designated the condition as "apoplexie utéro-placentaire" and was inclined to regard it as a manifestation of the toxæmia of pregnancy. The following year he reported two additional cases, in one of which the uterus was removed at autopsy after the patient had died from eclampsia, and was reproduced in colors in volume ix of the *Annales de Gynécologie*.

Following his publications, similar cases were reported from all parts of the world, so that I have been able to collect 20 which have been recorded during the past four years, namely 3 cases each by Couvelaire and Essén-Møller 2 cases by Zarate and one case each by Fabre and Bourret, Fieux, Zweifel, Berggren, Sprinth, Jüttner, Frapont, Clifford,

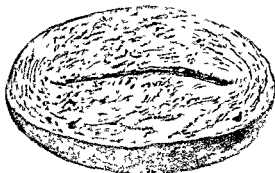


Fig. 1 Horizontal section through normal fresh puerperal uterus Hardened in formalin

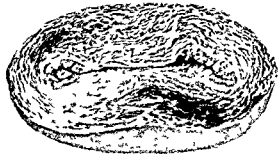


Fig. 2 Horizontal section through uterus removed on account of premature separation of placenta Hardened in formalin

King, Young, Brandt, and Shaw A number of these were mentioned quite incidentally, but others were accompanied by careful descriptions of the anatomical and histological findings, while the specimens of Zweifel and Zarate were reproduced in colored plates

It is evident that this enumeration is not exhaustive, for Young stated that he had seen five such specimens, and Shaw remarked that he had observed intramural hæmorrhage in four out of five uteri, which had been removed for the relief of accidental hæmorrhage Moreover, upon searching the literature, I found that a number of cases had been observed prior to Couvelaire's publication, but that great significance had not been attached to the condition of the uterus, which was usually casually mentioned In this category belong cases observed by Desmond, Weiss, Knauer, Seitz, Targett, LeLorier, Bar and Kervily, Keyworth and Monro-Kerr It is interesting to note that in Knauer's case the autopsy had been done by Kolisko, who described the condition as hæmorrhagic infarction of the uterus

From the evidence which I have adduced and from the description of my two specimens, it is apparent that the condition described is a frequent accompaniment of premature separation of the placenta, and may occur in patients presenting either concealed or external hæmorrhage, and in whom labor has ended spontaneously or has not yet begun It would be assuming too much to assert that it is a universal accompaniment of the accident, but the fact that it has been

observed so frequently during the past few years justifies the belief that it is of common occurrence, and now that attention has been directed to it that it will be noted very frequently at operation or autopsy In any event it is a very striking and characteristic lesion, which in the first place affords a satisfactory explanation for certain clinical manifestations, and in the second place indicates that the more serious cases of premature separation of the placenta are not due to mere local causes, but are manifestations of conditions originating outside of the generative tract

It is also important to note that the hæmorrhagic lesion is not limited to the uterus, but may involve the tubes, ovaries, or broad ligaments, as well In Couvelaire's first case both broad ligaments were involved, while in each of mine the right broad ligament was swollen and so congested as to be almost black in color, and similar findings have been recorded by other observers Furthermore, the tubes and ovaries may also be involved, as in my second case, and in one recorded by Keyworth

Occasionally large quantities of blood are found in the peritoneal cavity In most instances it apparently comes from fissures upon the surface of the uterus or broad ligaments, but exceptionally, as in the case of Keyworth, its origin was not evident

These fissures are more or less parallel to the long axis of the organ, rarely more than a few centimeters long, and usually extend only a slight distance into the muscularis They have been noted by many writers,

notably by Hicks, Weiss, Knauer, Kouver, Engstrom, Zweifel, Lieven, Shaw, and Fraipont, and were studied particularly by Knauer and Fraipont. The former believed that they resulted from the extreme distention of the uterus by the concealed hæmorrhage, but the latter contends that they are attributable to the rupture of distended vessels just beneath the peritoneal surface. Fraipont also directs attention to the fact that their existence has long been recognized, and states that Duparque in his monograph referred to a number of early cases. The practical significance of such lesions will be discussed later.

As has already been indicated Couvelaire designated the uterine lesion as uteroplacental apoplexy—a term which had been applied by Jacquemier to the hæmorrhage between the uterine wall and placenta, while Kolisko described it as a hæmorrhagic infarction. To my mind, neither term correctly describes the condition, but I am not prepared to suggest a better one.

When it is attempted to ascertain the significance of the lesions and the manner in which they are brought about, definite statements cannot be made and for the present we must be content with theoretical generalizations. In the first place, the hæmorrhagic lesions afford a satisfactory explanation for the first stages in the separation of the placenta, as it is only necessary for minute hæmorrhagic areas in the decidua basalis to coalesce in order to inaugurate the process, which, once begun, will continue and be stimulated by the enclosed collection of blood acting as a foreign body. In the second place, it is justifiable to assume that the tension of the uterine wall resulting from intramuscular hæmorrhage, and the consequent disassociation of the muscle fibers, may be a factor in producing a degree of shock out of proportion to the amount of blood effused into the uterine cavity or lost externally. Again the changes in the uterine wall afford a very satisfactory explanation for the imperfect contraction of the organ, and render it apparent why in the past so many women perished from atonic hæmorrhage after the completion of labor. And finally the vertical fissures upon the exterior of the uterus indi-

cate a rational origin for the intraperitoneal hæmorrhage, which sometimes complicates the condition, and renders it clear why patients occasionally succumb after a uterine hæmorrhage which could ordinarily be borne with impunity.

On the other hand, it is far more difficult to explain the mechanism by which the hæmorrhage occurs and its ultimate cause. I have already described the arterial changes observed in my specimens, and have stated that lesions of continuity were noted in some of the smallest arterioles, which would explain the escape of blood into the surrounding tissues. Most observers do not mention the condition of the vessels, or state that they were normal. Couvelaire could find no arterial changes, but stated that lesions of continuity were present in the veins, which would readily account for the intramuscular hæmorrhage. Young, on the other hand, detected no vascular lesions in the uterus, but found that the left ovarian vein was completely thrombosed, and explained the hæmorrhagic changes on the basis of obstructed circulation. In my two specimens, however, the large vessels were normal.

Accordingly it is apparent that the evidence at present available is too scanty and contradictory to admit of definite conclusions concerning the mode of production of the hæmorrhage, but, as in many instances similar lesions were present in the broad ligaments, tubes, and ovaries, it would appear plausible to assume that the factor concerned did not act exclusively upon the uterus, and in all probability came from beyond the generative tract.

The fact that arterial changes were present in both of my specimens renders it improbable that I had to do with mere accidental findings, and makes pertinent the query as to whether more careful search might not have revealed their presence in other cases. Time only can answer. But assuming that similar changes are found what influence could they have upon our conception of the entire process? Careful study of the arterial lesions in my specimens has led me to believe that they are toxic in origin, and are due to the action of some substance circulating in the blood,

which possibly also produces changes in the smallest arterioles and capillaries which permit the escape of blood into the tissues, just as is observed in certain varieties of snake poisoning

I am perfectly well aware that this is pure speculation, and, even if proved, that it would only bring us one step nearer the ultimate cause. Somewhat similar views have already been expressed by Bar, Couvelaire, Essen-Møller, and others, who believe that the entire process is in some way connected with the ordinary toxæmia of pregnancy and eclampsia, and, in the section on etiology I have referred to its supposed connection with those conditions. If such a connection could be proved for all cases the evidence would be incontrovertible, but such is not the case, as many examples of premature separation can be adduced in which the urine is normal, at least so far as the ordinary tests are concerned. Furthermore, arterial changes, such as I have described, have not been observed in the uteri of women who have died from nephritis or eclampsia.

One of my two patients, upon whose cases this article is based, presented albuminuria and probably nephritis, while in the other the urine was normal both before and after the accident, yet both presented identical uterine lesions with striking arterial changes. If the lesions in the first case were due to nephritis, to what were they attributable in the second? We do not know, but for the present at least I prefer to believe that they were both due to some common cause, which I assume to be "toxæmic" in character, but distinct from the usual toxæmia of pregnancy, and concerning the nature and origin of which I am ignorant.

Treatment. The important conclusions which can thus far be drawn from our studies are (1) That premature separation of the normally implanted placenta occurs much more frequently than is generally believed and may give rise to only trifling clinical symptoms or may put the life of the patient in the greatest jeopardy. (2) That in the severe cases, at least the accident is associated with profound disorganization of the uterine muscle by hæmorrhage the so-called utero



Fig. 4. Section showing disassociation of uterine muscle by hæmorrhage. Light areas indicate muscle, dark blood.

placental apoplexy. And (3) that its causation is probably dependent upon some as yet undifferentiated form of toxæmia, which may or may not be accompanied by albuminuria.

What deductions can be made from these conclusions for the guidance of the practitioner at the bedside? In the first place, it is important to remember that external hæmorrhage due to premature separation of the normally implanted placenta is relatively common, while concealed hæmorrhage is rare. Accordingly, the possibility of the accident should always be considered when dealing with antepartum hæmorrhage, and a tentative diagnosis should be made unless the existence of placenta prævia can be positively demonstrated. Furthermore, a diagnosis of concealed hæmorrhage should be made whenever a patient in the later months of pregnancy complains of intense abdominal pain, is pallid, and presents a uterus of ligeneous

consistency, in the absence of external bleeding and even of the clinical symptoms of shock.

The second important deduction is that hard and fast rules cannot be laid down for the treatment of premature separation of the placenta, but at the same time it should be regarded as axiomatic that even in slight degrees of separation the bleeding will continue until the uterus has been emptied of its contents, and is able to contract down upon and constrict the bleeding vessels. This, however, does not mean that the uterus should be emptied artificially in all cases of accidental hæmorrhage, as in many instances excellent results are obtained by expectant treatment. Thus, of the 17 cases which I have recently observed, 9 terminated spontaneously without special treatment, while 8 were ended artificially in the interests of the patients. All of the mothers, and 40 per cent of the children were discharged in good condition.

In general, the decision to interfere will depend upon the amount of blood lost and the general condition of the patient. If the hæmorrhage is slight, and is not associated with untoward symptoms, the case will usually terminate successfully by the unaided efforts of Nature, although it is understood that the patient should be watched carefully and interference resorted to upon the first appearance of serious symptoms.

On the other hand, if the bleeding is profuse and the condition of the patient serious, prompt intervention is necessary, when the choice of operation will depend upon the condition of the cervix—forceps, version, the introduction of Champetier de Ribes' balloon, or cæsarean section being employed, according to the exigencies of the case. The latter operation should be chosen only when the cervix is but slightly dilated or when the general condition of the patient is more serious than can be accounted for by the amount of blood which has escaped. In this event the condition is probably complicated by concealed uterine or intraperitoneal bleeding. In such circumstances, abdominal is preferable to vaginal cæsarean section, as it makes it possible to inspect the uterus care-

fully and to preserve or remove it as may seem expedient.

Moreover, it should be remembered that all danger has not passed with the delivery of the child through the maternal passages, whether spontaneously or artificially; as the uterus frequently fails to contract satisfactorily, and death from atonic hæmorrhage may result, unless radical measures are taken for its relief. Accordingly, when such an accident supervenes, time should not be wasted in employing hot intra-uterine douches, ergot, or pituitrin and similar measures, but the uterus should be immediately packed with gauze. If this leads to forcible contractions and completely checks the bleeding, well and good, but if blood-tinged serum makes its way through the pack the abdomen should be immediately opened and the uterus removed *in toto*, or amputated supravaginally, according to the predilections of the operator. Zweifel has reported that three such operations were necessary in the last 22 cases of external accidental hæmorrhage which he treated.

In times past such a recommendation would have seemed to represent the height of radicalism, but, now that we are acquainted with the hæmorrhagic lesion of the uterus, operative interference is clearly indicated, as in such cases the organ is so damaged by intramuscular hæmorrhage that it is unable to contract and retract satisfactorily, so that its retention is practically synonymous with death from atonic hæmorrhage.

Again even though the empty uterus may have apparently contracted and retracted satisfactorily and there be no external hæmorrhage, the patient may pass into a condition of shock, or be depressed out of proportion to the amount of blood lost. In such circumstances one should always consider the possibility of intra abdominal bleeding from the superficial fissures which so often develop upon the peritoneal surface of the uterus, when, even though the physical signs indicative of free blood in the peritoneal cavity cannot be elicited the abdomen should be opened. If hæmorrhage has occurred, the uterus should be removed, but if a mistake in diagnosis has been made, no great harm

will be done the patient, and the obstetrician will experience a feeling of security which he could gain in no other way

It will be noticed that I have said nothing concerning the advisability of rupturing the membranes or of "plugging" the vagina, in case the cervix is not sufficiently dilated to permit prompt delivery. I have done so deliberately, since they are not needed in the milder cases, while in the severe ones they cause the physician to delay in resorting to the radical measures which are essential to the salvation of the patient

The indications for treatment are even simpler when a diagnosis of concealed accidental hæmorrhage has been made. In this event cesarean section is the operation of choice, except in the rare cases in which the cervix is fully dilated when the patient is first seen, when the child should be promptly delivered by the appropriate obstetrical procedure. But under all other conditions, I am convinced that immediate abdominal cesarean section will be the most conservative procedure for the mother and the only one which offers the slightest chance for the child

For many years the more radical obstetricians have urged it as the simplest means of emptying the uterus and enabling it to check the hæmorrhage by its contraction, but the recognition that the problem is not so simple, and that the peculiar danger of the condition lies in the disorganization of the muscular wall of the uterus by the hæmorrhage, which has deprived it of the power of contraction makes the conservative obstetrician advocate cesarean section as the ideal method of procedure and the only one which gives reasonable promise of insuring the life of the patient. I am confident that the two women, whose histories form the basis for this paper, owe their lives to my decision and that no one who has seen or felt the atonic infarcted uterus, which seems to characterize this condition, would ever again be willing to take the chance that it would contract satisfactorily after the completion of labor. This does not necessarily mean that the uterus should always be removed, for it should be retained if it has not been too damaged to



Fig 3 Section showing degenerative arterial changes

fulfil its immediate function of controlling hæmorrhage by contraction and retraction

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WHAT HAS THE AMERICAN GYNECOLOGICAL SOCIETY DONE FOR GYNECOLOGY¹

BY THOMAS J. WATKINS, M.D., F.A.C.S., CHICAGO

AT our last annual meeting, our president, J. Whitridge Williams, gave a valuable and interesting address entitled, "Has the American Gynecological Society Done Its Part in the Advancement of Obstetrical Knowledge?" With the idea of continuing the study of the work that the Society has done, supplementary to Dr. Williams' address, I have selected as my subject, "What Has the American Gynecological Society Done for Gynecology?"

All of the presidential addresses have been read, and all papers and discussions of gynecological subjects have been reviewed. The task of conscientiously reading the above in all of our thirty-nine volumes of transactions has been arduous, yet interesting, and I feel well repaid for the time expended. Six hundred eighty-three papers have been presented upon gynecological subjects, not including ectopic pregnancy, by one hundred ninety authors.

The work of Thomas Addis Emmet. The first paper read before our society was by Thomas Addis Emmet. The great value of his contributions induces me to believe that it would be interesting to refer briefly to them. He gave a presidential address, contributed eleven papers, and took an active part in discussions throughout the early history of the society. His chief contributions were upon uterine displacements, vesicovaginal fistulae, perineorrhaphy, and trachelorrhaphy. His first paper upon uterine displacements contained a statistical study of 2,447 cases. The clinical histories which he kept and the observations which he recorded to obtain the information contained in this paper would even now be models for imitation. The value of this work as an incentive to others to do accurate, scientific, clinical work is beyond estimation. A second paper on uterine displacements is notable for the statement "The degree of prolapse below or the elevation of the uterus above, a certain plane causes

the symptoms now usually attributed to version alone." This plane he named the "health line." This paper was, in many respects, years in advance of the general knowledge of uterine displacements, as the profession has only of late appreciated the fact that prolapse is the only uncomplicated uterine displacement that is of any pathologic importance.

The observations and deductions of Emmet given in his paper on the etiology of vesicovaginal fistulae, settled for all time that the obstetric forceps are not the cause of fistulae; that fistulae usually result from neglected impaction of the fetal head in the pelvis.

Emmet's contribution on laceration of the perineum was a milestone in the development of gynecology. He found that the perineal body was not a "wedge support" to the pelvic organs, and established the fact that the strength of the perineum as a pelvic support depends upon the integrity of the levator ani muscle and its fascia. Little has been added to his pathology of laceration of the perineum; the technique of repair of injuries to the levator ani muscle and its fascia has been improved. Emmet's contribution on laceration of the cervix eliminated "ulcer of the cervix" from textbooks. He appreciated and often remarked that "trachelorrhaphy is a much-abused operation."

It pleases me greatly that I am given this opportunity to pay a meager tribute to Emmet, the undoubted master of plastic surgery in gynecology.

Emil Noeggerath. The most classical paper of the thirty-nine volumes of the transactions of the American Gynecological Society was contributed by Emil Noeggerath in 1876, on "Latent Gonorrhea, Especially with Regard to its Influence on Sterility in Women." Justice could be done this marvelous paper only by quoting it almost in its entirety, as nearly all of it has stood the test of time and as it contains little that could be eliminated

¹ Presidential address before the American Gynecological Society, White Sulphur Springs, West Virginia, May 29, 1915.

The following extracts are so notable that I beg the privilege of quoting them

"Now, Mr. President, this combination and development of symptoms, physical as well as rational (referring to cases reported), you will never encounter in women married to husbands that have not exposed themselves to the dangers of venereal affections. I say, advisedly, never! and if any one has a right to speak thus positively, I claim this privilege

"The affection (gonorrhœa) is cured, in the male, whenever the urine -- loaded with or even without, the *antidotes*¹ -- comes in contact, and sweeps away the newly formed secretion, while beyond this point the disease often persists for life in a milder form

"Among one hundred and five cases of which I have written notes, I found --

"10 patients suffering from acute and sub-acute *perimetritis*;

"8 patients suffering from recurrent *perimetritis*,

"38 patients suffering from chronic *perimetritis*,

"17 patients suffering from chronic ovaritis,

"32 patients suffering from catarrh of the uterus, apparently uncomplicated

"the non puerperal is always *perimetritic*

"Wherever I have had occasion to examine post mortem under these circumstances I have found the existence of salpingitis, and in those cases which could be carefully investigated during life, the history of gonorrhœa, either in the patient herself or in her husband, has rarely been absent

"With regard to recurrent *perimetritis*, I venture to state that every single case has its remote origin in gonorrhœa

"This catarrh extends upward to the fundus, and always into the fallopian tubes. The vaginal mucous membrane is often intact, while that covering the vulva is, as a rule, involved to some extent. It is (signs of gonorrhœa) catarrh and erosion of and around the orifices of the ducts of the vulvovaginal glands"

Noeggerath reported the microscopic findings from the examination of semen in four-

teen husbands of women suffering from sterility: in seven of them he found an absence of spermatozoa, in four defective spermatozoa, and in three a large number of living spermatozoa

This paper comments upon the observations of Littre, 1711 E. Bernitz, Cushman, Vosselin, and Liegeois, on the pathology and observations in cases of gonorrhœa

Very little has been added to what Noeggerath gave in this paper on the etiology and macroscopic pathology of gonorrhœa. The discovery of the gonococcus by Neisser made it possible for Noeggerath's followers finally to appreciate and assimilate his teachings. The facts presented in Noeggerath's paper were so thoroughly supported by recorded observations and logical deductions that it seems impossible that they were not appreciated and accepted at that time. The slowness with which his discoveries were accepted is well illustrated by quoting a discussion made sixteen years later by one of our most highly esteemed Fellows who said "I must admit that I have found myself entirely at variance with Dr. Noeggerath with regard to the effects of gonorrhœa in women"

I ANATOMY, PHYSIOLOGY AND BACTERIOLOGY

Creditable papers have been presented upon the anatomy of the pelvic floor, the anatomy and development of the hymen, and upon the anatomy and physiology of the ovary. The contributions upon the corpus luteum have added to our knowledge of the menstrual disturbances

One excellent and two creditable papers have been contributed upon bacteriologic subjects

II INJURIES OF CHILDBIRTH

Laceration of the perineum. J. Collins Warren, in 1882, presented a valuable and original paper on repair of complete laceration of the perineum which consisted chiefly in individual dissection and suture of the sphincter ani muscle. Emmet's contributions upon this subject have been mentioned above. Twelve other papers upon laceration of the perineum are concerned largely with individual suture of the sphincter ani muscle or improved methods of restoration of the

¹ Trial or mine

injured levator ani muscle and its fascia, all of which are fundamentally modifications of the Emmet or Hegar operation

Cystocele and urethrocele Nineteen papers have been contributed upon the former and four upon the latter subject. Numerous operations have been advocated for repair of cystocele, notably clytorrhaphies, anterior vaginal fixation of the uterus, fixation of the round ligaments, the Goffe operation, interposition of the uterus, and suspension and fixation operations by abdominal section. Shortening of the uterosacral ligaments has also received much attention in conjunction with the above mentioned operations. The relative value of these procedures has not been entirely determined, their merits at present seem to be largely a question of the individuality of the case and the experience of the operator.

Four papers deal with urethrocele and indicate that it is best treated by restoration to its normal location and fixation by lateral sutures to fixed tissue, or by fixation in conjunction with some of the cystocele operations.

Vesicoaginal fistula Nine papers appear on this subject, excellent papers having been contributed by Emmet, Bezeman, and others. The more recent papers show that the chief improvements which have been obtained over the Sims and Emmet operations have consisted chiefly in making sufficient separation of the bladder laterally and from the cervix to permit approximation without undue tension upon the sutures.

Laceration of the cervix Eleven papers appear upon laceration of the cervix. The fact that only one paper appears in the transactions since 1892 indicates a unanimity of opinion upon this subject. The Fellows probably seldom operate now for laceration of the cervix except in conjunction with other operations, and then only for the removal of much hypertrophied tissue or extensive erosions, and they adapt the kind of operation to the individual case.

III PELVIC INFECTIONS

Our transactions contain very little information relative to pelvic infections, except

in the paper of Noeggerath above considered, before the date of publication of Tait's work upon salpingitis. From this time on the Fellows of this society took an active and important part in the clinical study, in the pathology, and in the treatment of infections of the fallopian tubes and ovaries. This work represents a period of rapid advancement of the knowledge of the pathology and treatment of pelvic diseases. Notable papers were contributed relative to the conservation of tissues and organs.

The impunity with which the ovaries were removed at that time is well illustrated by quoting from a discussion made by one of our prominent Fellows in 1894, who said: "For no one, I think, but an extra conservative would wish to leave them (the ovaries) after removing the tubes." Some of the earlier papers suggested at least the belief that ovulation in some patients was detrimental to health.

Many papers were presented and much discussion given during the years 1892 to 1903 upon such topics as the indications for hysterectomy when both tubes are removed, conservative operations upon infected tubes and ovaries, and vaginal versus abdominal section.

The frequent involvement of the appendix in cases of pelvic infections, the importance of general abdominal exploration, and the advances made in asepsis, were prominent factors in determining the relative values of abdominal and vaginal celiotomy.

The fallacies of curettage as a curative remedy in so called endometritis have been established.

The relation of appendicitis to pelvic diseases was called to the attention of the society in 1892 by Keating. Ten other papers have since appeared upon this subject.

The study of infections of the urethra, bladder, and kidney has not been neglected by the society.

IV DISPLACEMENTS OF THE PELVIC ORGANS

Forty eight papers have been contributed upon displacements of the uterus, not including prolapse which was considered elsewhere. If we concede that the only pathologic

uterine displacement, excluding complications, consists in disturbance of its "health line," then we must conclude that not all of these papers were valuable and original productions. Most of these papers deal with ventral suspension, vaginal fixation, and round and utero-acral ligament operations. The round ligament operations have finally become the ones almost universally employed.

Seven creditable papers have been presented upon inversion of the uterus. An original contribution given in 1899, which consisted in posterior vaginal incision of the constricting ring, is deserving of special mention. This operation has been improved by an anterior vaginal incision of the constricting ring.

V. PELVIC NEOPLASMS

The transactions contain fifty-one papers upon uterine fibromyomata. The large number of papers upon this subject is a natural sequence of the great advance that has recently been made in the treatment of uterine fibroids. Interesting and valuable papers appear in the transactions upon—

- a. Removal of fibroids by enucleation through the vagina
- b. Fixation of the pedicle in the abdominal wound
- c. Elastic ligature for the pedicle
- d. Vaginal fixation of the pedicle
- e. Total hysterectomy
- f. The classical hysterectomy of Barr Goffe, and Palmer Dudley
- g. Myomectomy

The American Gynecological Society has done valuable work in the development of the perfected operations for uterine fibromyomata. Gordon's dictum, "Fibroid tumors that produce symptoms should be removed," has been vigorously opposed but finally has become generally accepted. Papers on the degenerative changes in fibroids, on the history of hysterectomy, and on the circulation in fibroids are valuable contributions.

Cancer of the uterus. There are thirty papers upon cancer of the uterus. John Byrne contributed excellent papers upon this subject in 1877, 1889, 1892, and 1896. Byrne's results, as given in his statistics, are the best that appear in our transactions.

Forty-two papers have been contributed upon ovarian and other pelvic tumors.

It is interesting to note that seventy-six papers appear upon medical gynecology.

The society has done very creditable work upon repair of injuries to the ureters. A large amount of good work has also been done upon tuberculosis, technique, post operative complications, menstrual disturbances, and sterility.

In reviewing our work I have appreciated the danger of criticism in giving individual credits to men still active in the work. It is impossible to give you all the credit which you deserve. Although our transactions often show the need for work that can only be done in large clinics with adequate financial support, our thirty-nine volumes is a valuable contribution to gynecological literature.

WHAT IS THE FATE OF THE OVARIES LEFT IN SITU AFTER HYSTERECTOMY¹

BY HIRSH N. VINEBERG, M.D., F.A.C.S., NEW YORK

THE writer, at the outset, will confess he has always been prejudiced against leaving behind one or both ovaries, when, for one reason or another, the uterus had to be removed. This prejudice was born of an experience early in his surgical career, when he was compelled to operate for the purpose of removing the ovaries in a young woman in whom the uterus was congenitally absent and who had suffered severely from menstrual molimina from her sixteenth year onward. He could not comprehend wherein lay the difference between this congenital condition and that created by the operator when he removed the uterus and left the ovaries *in situ*. Still, notwithstanding this state of mind, he could not escape the influence, from time to time, of the glowing reports in the literature made by distinguished operators of the great advantages accruing to the patient from having one or both ovaries conserved, when the uterus had to be removed. These patients, so the reports stated, were spared the annoying and sometimes the distressing symptoms of the climacteric, and many of the other phenomena said to be due to the lack of the material which the ovaries secrete. It would seem, as if by a trick of fate, that of the few instances in which the writer allowed himself to be influenced in this manner two of his patients had to undergo a secondary laparotomy because the retained ovary had undergone cystic degeneration. It therefore occurred to him that it might be of interest and of scientific value to ask what changes actually take place in the ovaries that are left *in situ* after the uterus has been removed and how frequently do they undergo cystic and other degenerations necessitating secondary operation for their removal? In order to obtain all the data possible the writer took the liberty of writing to most of the Fellows of the American Gynecological Society asking them if they would not kindly

investigate their cases regarding this point and present their results in the discussion of the paper. In this way valuable data could be obtained which might serve as a guide in our future work.

A search of the literature with the stated object in view did not disclose very much material upon the subject. A list of articles upon the subjective side of the subject were encountered, but comparatively few dealing with it from the objective side. This perhaps is natural from the exigencies of the subject, for the opportunity is not often offered to examine the retained ovaries microscopically a variable period after the hysterectomy. The observations made as to the changes of the retained ovaries, based upon a bimanual examination, we all know are practically worthless. Reports of autopsies regarding this point are found only here and there in the literature. As a substitute for this deficiency, experiments have been made upon rabbits by several observers. Grammatikati (15) who was the first to make such experiments—that is, excising the uterus from the rabbit and later examining microscopically the ovaries that had been left *in situ*—found the ovaries had shown practically no retrogressive changes, the follicles were found in every stage of development and the ovarian tissue was normal in every respect. Mandl and Buerger (20) later made an extensive series of similar experiments. Their results differed in some respects from those of Grammatikati. They examined the retained ovaries after a period varying from eight months to three years. In all instances whether after the shorter or longer period they found numerous follicles in various stages of development and retrogression up to the formation of typical corpora lutea. But the number of primordial follicles was less than those found in the control animals. In addition they found in the ovaries of the rabbits experimented upon

¹ Read before the American Gynecological Society, White Sulphur Springs, West Virginia, May 25-28, 1915.

effusion of blood into the larger follicles with cystic degeneration of some of them, and decided evidences of a certain degree of atrophy of the entire organ. Summing up the results of the histological findings in the four series of experiments upon rabbits, they state that after the extirpation of the uterus, regardless as to whether the elapsed time was of longer or shorter duration, they observed certain changes in the ovaries which justified the conclusion, first, that the blood supply of the retained ovaries did not correspond to the normal, second, that the return flow of the blood was interfered with, leading to congestive changes with all their consequences and that also the developmental changes on the surface of the organ were, to a certain degree, interfered with, so that, altogether, the functioning condition of the organ in a certain sense, was rendered more difficult.

These observers made similar experiments upon apes, but they state that while this species is more closely related to the human, there is such a great difference in the follicular development and retrogressive changes in their ovaries from those observed in the human ovaries that they are not as well suited for experimental study as the rodents.

The results of the experiments in the apes showed also some evidence of congestion and a tendency to cystic formation.

The experiments of Burekhardt (8) and Keitler (18) upon rabbits gave results similar to those obtained by Mandl and Buerger (20). The discrepancy between the results obtained by these observers and those by Grammatikati is explained by the circumstance that the latter's observations were made from three to four months after the uterus had been extirpated; in other words, the elapsed period was too short for any changes to have taken place.

Keitler very properly draws attention to the fact that the results obtained by experiments upon rabbits cannot entirely be applied to the human, inasmuch as the blood supply to the ovary of the rabbit differs essentially from that to the ovary of the human female. In the ovary of the rabbit the blood is supplied by an independent single artery, while the human ovary receives its blood from two

different arteries, the ovarian or spermatic and a branch of the uterine, which he names the "ramus ovaricus." The branch of the uterine going to the ovary is usually of larger caliber than the spermatic artery. Hence, in removing the uterus from the human female, the retained ovary is deprived of the greater part of its blood supply, which is not the case when the same operation is performed upon the rabbit.

Recognizing the importance of the blood supply of the ovary coming from the uterine branch the advocates of retaining the ovaries, as for instance Ol-hausen and Werth (26), recommended a technique whereby this blood supply should not be disturbed. To test the validity of this technique Keitler made a number of experiments upon the cadaver in which the vessels had been previously injected. He found that in every instance in which the technique as described by these authorities had been faithfully carried out, the ovarian branch of the uterine artery was cut off. He then endeavored by the most careful and tedious dissection, such as would not be feasible in the living subject, to remove the uterus without interfering with the course of the "ramus ovaricus." This, he was enabled to do only in a very few instances; in nearly all the cases the vessel had to be cut.

Ol-hausen advocates another technique for the same purpose which consists in burying the ovary between the two layers of the broad ligament. Other operators are of the opinion that this technique may favor the development of cysts and other degenerative processes. Werth lays great stress upon suturing the ovary to the angles of the cervical stump and suturing the layers of the broad ligament to the tunica albuginea. Zweifel and Abel (1) are strongly of the opinion that there is an interdependence between the uterine mucosa and the ovaries, and that in order to prevent a rapid atrophy of the retained ovaries some of the endometrium must be conserved. Hence they advocate and practise a very high amputation of the uterus. Mandl and Buerger (20) and others dispute this claim of Zweifel and Abel (1) and they claim these authors attach much too great importance to the influence of the

uterine mucosa upon the ovaries. The criticism may be well taken theoretically, but practically we know that menstruation will continue normally if only enough of the mucosa and uterine tissue is conserved. And as long as menstruation persists, we may safely assume that the ovaries continue functioning.

But the important question under consideration is, for how long a period do the ovaries continue functioning after the entire uterine body has been removed? As has already been stated, the objective data bearing upon this point are rather limited in number.

Grammatikati (15) examined the ovaries of a woman who died from an intercurrent disease, three years after a total extirpation of the uterus for carcinoma. There were no evidences of any atrophic changes, follicles were found in all stages of development and a false corpus luteum was observed. Keitler performed autopsies in five cases, but he thinks the patients were too far advanced in years to attach any significance to the results. This comment certainly does not hold good, for at least two of the patients were 42 and 46, respectively. In the patient of 42 it was not stated how long a time had elapsed after the hysterectomy. The retained ovary did not show any marked atrophy, but there were found numerous ripe follicles as well as several primordial follicles. In addition there were seen on the surface of the ovary several cysts the size of beans. In the patient of 46 the autopsy was done four years after the hysterectomy. Both ovaries were markedly atrophied and cystic, and no follicles were found. In two other patients, both 50 years of age, autopsy was done three years after the hysterectomy for carcinoma. In both instances the ovaries were greatly atrophied and markedly cystic, and no follicles were observed. Keitler (18) quotes Gottschalk who did a secondary operation a year after the hysterectomy and found the retained ovary contained numerous ripe follicles. Mandl and Buerger (20) report a case of secondary operation in a patient of 40, five years after a vaginal hysterectomy for parametritis and an abscess the size of a

closed fist in the cul-de-sac of Douglas. The left ovary was left behind, as it could not be removed on account of dense adhesions. The right adnexa appeared normal and were left *in situ*. The second operation consisted of a laparotomy for the removal of a right hydrosalpinx and adherent ovaries. The right ovary contained several ripe follicles but a great many were in a state of atresia. There were other evidences of atrophic changes. The left ovary was for the most part converted into a cyst. Normal follicles were not found in either ovary. Pronai had the opportunity to examine the ovaries of a woman, 31 years of age, in whom four and one fourth years before, a vaginal hysterectomy had been done for adenocarcinoma of the body of the uterus. The secondary operation was a laparotomy for a recurrent growth. Both ovaries were the size of a hen's egg, and microscopic examination showed a great decrease in the number of primordial follicles. There was a total absence of corpora lutea and only a few markedly atrophied corpora candidantia were present. Therefore it may be stated that the ovaries did not possess a full functioning capacity but presented the beginning stages of atrophy.

Holzbach (17) reports the case of a woman 39 years of age upon whom a vaginal hysterectomy for carcinoma was performed in February, 1899. The woman suffered for six months afterward from attacks of irritability, excitability, hot flashes, etc., at intervals of four weeks, lasting from two to three days. She was operated upon again in 1906, seven years later, for a recurrent growth in the pelvis. There was a hydrosalpinx of the left tube. The left ovary was cystic and enlarged and was the seat of a carcinomatous growth involving more than half of the organ. The cortex and albuginea were for the most part suffused with blood. There was marked hyaline degeneration of the numerous obliterated vessels. Large corpora albicantia were present but no follicles. The right ovary was imbedded in adhesions. It was about the normal size and presented a good sized hematoma of corpus luteum origin. There were several corpora albicantia and follicles in every stage of development.

Agnes Blum (6) cites a case of a woman 40 years old, upon whom vaginal hysterectomy for fibrosarcoma of the vagina was done in 1900. She was operated upon again in 1903, three years later. The right ovary showed but slight changes from the normal. The left ovary contained a fresh corpus luteum. In addition, there were several old corpora lutea. There were small follicular cysts the size of peas, lying close together, thus showing a commencing cystic degeneration.

Werth (26) had an opportunity to examine the retained ovaries in four cases. Case 1. Age 47 years, supravaginal hysterectomy for large fibroid. Both ovaries were left *in situ*. Laparotomy 18 months later for intestinal adhesions revealed the left ovary to be scarcely of medium size, while the right ovary was double the normal size. Both ovaries were covered with smooth adhesions. No report of any microscopic examinations. Case 2. Age 50 years, supravaginal hysterectomy for multiple fibroids. The left ovary was retained. The patient died suddenly a month later from pulmonary embolism. At autopsy, the ovary was apparently normal. No microscopic examination made. Case 3. Age 32 years, September 1899, vaginal hysterectomy for cervical cancer. Both ovaries and tubes were apparently normal, and left *in situ*. The patient died of recurrence December, 1899. The left ovary was of medium size and the tube was adherent to the sigmoid. The right adnexa healed normally, the only change noted microscopically was a hyaline degeneration of some of the follicles. Six months before death the patient was seen by Werth. She had had no menstrual menses nor any of the symptoms referable to the climacteric. Werth presents the case as a forcible illustration of the value of conserving the ovaries. But to the writer the illustration does not appear so conclusive, inasmuch as a woman who has had a comparatively early recurrence which ends in death a little over three years after the operation is probably suffering from severe symptoms due to the recurrence, which would overshadow any that might occur dependent upon the artificial climacteric.

Case 4. Vaginal hysterectomy for intra-ligamentary fibroid. The patient died eight months later from ileus. Werth attaches no significance to the case, but states he reports it merely because of the dearth of such material in the literature.

From the foregoing observations in animals and in the human subject, the conclusion is justifiable that the ovaries continue functioning for a longer or shorter period after the uterus has been removed, in spite of the fact that, at least in the human subject, the blood supply of the ovary is very materially disturbed by the operation. It has also been fairly well established that a progressive atrophic process sets in some months after the operation, but the data are as yet insufficient to enable us to say at what period this process becomes so complete as to destroy all of the follicles. It is to be hoped that opportunities will occur in the near future by which it may be possible to collect sufficient data upon that point.

The writer will now turn his attention to the reported cases of cystic and other degeneration of the retained ovaries found in the literature.

A. Martin (quoted by Abel 1) performed supravaginal hysterectomy for fibroid growth in a woman 37 years of age, leaving the right adnexa which looked perfectly normal, *in situ*. Seven months later he was compelled to operate again for an enormous cyst of the ovary filling the entire abdomen.

Pean (22) reports a case in which at the next menstrual period following the operation there was a hemorrhage from the retained ovary leading to death. Prochnowicz states he had to operate the second time in four cases on account of malignant degeneration of the ovaries left *in situ*.

A. Calman (9) reports a case of hysterectomy for fibroid tumor with disease of the right adnexa, which he removed. The left ovary appeared normal and was left *in situ*. Three years later a second operation was necessary for a cyst of the size of a fetal head (evidently a corpus luteum cyst). The patient suffered from the climacteric syndrome after the first and after the second operation.

G G Bantock (5) relates a case in which he had to perform ovariectomy for cyst of one of the retained ovaries seven years after a vaginal hysterectomy for cystic disease of the uterus. No trace could be found of the other retained ovary.

Littauer showed an ovarian tumor the size of a closed fist which he removed per abdomen, nine months after a vaginal hysterectomy for fibroid.

Olshausen reported four cases of cysts of the retained ovaries necessitating a secondary operation after vaginal hysterectomy for carcinoma uteri. These occurred three months, five months sixteen months, and nine years, after the primary operation. Although a warm advocate of retaining one or both ovaries he added he could report several more cases of cystic degeneration of the retained ovaries.

Fischer reported a case of cyst, the size of a closed fist, of the retained ovary two and three-fourths years after vaginal hysterectomy for chronic metritis and diseased right adnexa.

Waldstein cites four cases of cystic degeneration of the retained ovarian tissue, occurring in Schauta's clinic after hysterectomy but in these instances there was no intention of leaving any ovarian tissue behind.

Werth narrates the histories of two cases operated upon for cystic degeneration of the ovaries following a vaginal hysterectomy, one for myoma, the other for tuberculosis of the uterus and of the tubes.

Mandl and Burger (20) report one case in which the retained ovary was converted into a cyst, the size of a hen's egg, three years after hysterectomy.

Abel (1) is credited by several writers with the report of cases of cystic degeneration of the retained ovaries after the uterus had been removed. A careful perusal of Abel's article by the writer has failed to find any such cases. Abel states that in some cases he was able to determine an enlargement of the retained ovary some months after the hysterectomy but that at a later examination the ovary was found much reduced in size. His article is based on Zweifel's method whereby the ovaries are retained with as much of the uterine tissue as possible, so

that a portion of the uterine mucosa is conserved.

The writer wrote to several of the Fellows asking them to kindly come prepared to the meeting with data collected from their own experiences conserving secondary operations for cystic or other degeneration of the retained ovaries following hysterectomy. Owing to his inability to attend the meeting last year, the paper was not read until the meeting of this year, and it will be instructive to embody the replies received from the Fellows last year.

Dr H C Coe wrote he had had three cases requiring secondary operation for cystic degeneration of the retained ovaries. He adds that even when the ovary does not become cystic it sinks to the bottom of the Douglas cul de sac, causing painful symptoms.

Dr Palmer Findley writes he can recall but one instance wherein the ovary became markedly enlarged through cystic degeneration, following a vaginal hysterectomy. He adds "Do you find the ovaries occasionally undergo an acute degeneration but disappear more or less after a number of weeks' time? A condition which I describe to be temporary obstruction to the circulation."

Dr I S Stone relates a case of secondary operation for obstruction. He states that he found the retained ovary dark, almost black with venous blood, and swollen to more than double its size.

Dr Thomas S Cullen states that he leaves the ovaries, wherever it is possible, in patients under 45 years of age, and that he has yet to see any apparent trouble develop as the result of the ovaries being preserved.

Dr W M Polk writes "I have had no bad results from leaving ovaries when operating, but confess that I think the procedure has only a sentimental value. When first I advocated it many years ago, it was during a period when ovaries were being transplanted. It was my hope that these ovaries might live, and at any rate mitigate the enforced menopause of patients upon whom hysterectomy had been performed. As I have intimated, however, I did not think that any real mitigation occurred. This fact, together with a feeling that such an ovary might serve as a nidus for a subsequent tumor, occasioned me to abandon my former plan and take the ovaries along with the uterus."

Dr Joseph Brettauer "Until quite recently I always removed the ovaries with the uterus when operating for fibroids. Within the last year or two, I have left them *in situ* but have had no opportunity to observe results as yet."

Dr Howard C Taylor "I rarely leave an ovary when I do hysterectomies." He asks "if an ovary that has been resected and left in becomes cystic more frequently than a normal ovary."

Dr W. W. Chipman makes it a practice of always leaving the ovary when a hysterectomy is performed if they are at all healthy, no matter what the age of the patient may be. Clinically he has seen no evil results from the procedure.

Dr E. B. Cragin's records show 353 hysterectomies in which one or both ovaries were left behind, and there is no record of any case having returned with any condition of the ovaries requiring a second operation.

Dr Wm. P. Graves usually takes out the ovaries with the uterus.

Dr W. E. Ford left in ovaries only after a vaginal hysterectomy, a practice which he gave up several years ago. He never believed in leaving the ovaries in from the first, and therefore always removes them with the uterus.

The following are brief histories of two cases of cystic degeneration of the retained ovary, in the writer's practice.

CASE 1. Mrs. B., age 28, had in July, 1905, a supravaginal hysterectomy for an interstitial fibroid the size of a fetal head. Owing to her youth the left ovary, which was apparently normal, was left *in situ*. The post-operative course was practically afebrile and she made an uneventful recovery. Five or six weeks after the operation she was attacked with typhoid fever. At the outset until the diagnosis was established, there was considerable uneasiness whether the retained ovary might not have undergone a suppurative process causing the fever, as the patient had rather a thick and rigid abdominal wall and a bimanual examination was not satisfactory. The typhoid ran rather a severe course, but the patient ultimately made an uncomplicated recovery and she was restored to her usual good health. For the following eighteen months she suffered considerably from hot flashes and from nervous irritability. In October, 1909, an interval operation was done for appendicitis. The appendix was removed through an incision at the usual site and no attempt was made to inspect the pelvic contents. The recovery from the operation was normal and rapid. During the spring of 1912 the patient complained of attacks of pain in the left iliac region and on one occasion ran a moderate temperature, 101° 102° , for a few days. When examined by me in July, a cystic mass, the size of a mandarin orange was palpable in the left iliac region. In October, 1912, I reopened the abdomen, at the side of the old median incision, and found no visible trace of any ovarian tissue, but a cystic mass of the size stated above, most intimately and extensively adherent to the intestines. The excision of the cyst proved a most ticklish and tedious task. A determined effort was made to remove every vestige of the cyst wall, and as far as one could judge with the naked eye, this was accomplished. The patient passed through a couple of stormy days after the operation, then the convalescence was afebrile and rapid. On bimanual

examination, about three weeks later, the pelvis was found entirely normal. But on another examination about three months later a cystic mass the size of an English walnut was found in the region of the former cyst. The patient from time to time up to the present has twinges of pain in that region. The cyst, at times, seems smaller, at other times it appears to be about the same size. Before the third operation (that is for the removal of the cyst) the flashes had entirely ceased. "Since the operation the hot flashes have returned, lasting for a week or two at a time, without any regularity or rotation, that I can discover" (the patient's statement).¹

CASE 2. Mrs. L. M., age 34, married nine years, 2 children, last child twenty-one months ago. On October 19, 1912, she had a supravaginal hysterectomy done by me for multiple fibroids, forming a mass the size of a fetal head. There had been an operation for appendicitis some years before, and as a result the omentum was extensively adherent to the right parietal wall. The patient had very strong sentimental opinions against the removal of the ovaries, and a promise was given that one or both would be conserved if possible. As the right adnexa seemed perfectly normal, they were left *in situ* and attached by a couple of catgut sutures to the cervical stump which was amputated high up at about the os internum. The recovery was perfectly normal and satisfactory. At the end of three weeks, on bimanual examination the cervical stump was freely movable and the retained ovary did not seem any larger than it should be. January 15, 1913, the patient consulted me to see if it were possible that she had become pregnant. She stated she had spotted only twice since the operation. On examination I found a cystic mass the size of a closed fist in the right lower quadrant of the abdomen. March 13, she consulted me again on account of pain in the right iliac region, and a constant feeling of discomfort in that area. The mass did not seem to have grown any larger. In September of the same year, during my absence from the city, she was operated upon by another surgeon who has kindly responded to my letter of enquiry that he found a cyst (size not stated) of the right ovary surrounded by adhesions, which he removed, the patient making a perfect recovery. The patient herself has written in reply that since the second operation she has felt perfectly well.

A third case was seen by the writer in his office, in which on bimanual examination a cyst of the size of a closed fist was found in the right side of the abdomen. There had been a hysterectomy some years before by another surgeon. As the diagnosis was not confirmed by operation, the writer lays no stress upon the case.

It will be seen from the foregoing that although the number of cases found in the

¹ The patient since this has had to undergo another operation for the removal of a small cyst extensively adherent to the intestines, the result of cystic degeneration of some ovarian tissue not visible to the naked eye at the prior operation.

literature of cystic degeneration of the ovaries necessitating a secondary operation is comparatively small, it is, nevertheless, a contingency which must be reckoned with. It may also be safely assumed that not all the cases with this unfortunate sequelæ have found their way into the literature. The writer realizes that his experience in this connection is probably unusual, but in all candor he cannot attribute it to the technique employed, which was in accordance with that in use by other operators. Besides, there does not seem to be any one technique agreed upon by those who have given the subject careful study by which such a sequela can be prevented.

The original intention of the writer was to limit his paper strictly to the question as stated in the title, but he thinks now such a limitation would be unsatisfactory. He feels that a few words relative to the clinical side may be expected of him. The interesting clinical phenomena connected with the subject are: I. Menstrual molimina. It will be recalled that the writer stated at the outset that the fear of this prejudiced him against the retention of the ovaries when the uterus had to be removed. This view was one entertained by Hegar and others. The symptom was present to a distressing degree in several cases reported in the literature, notably in the articles by Glaevecke (14) and Brennecke (7). Most writers admit its occurrence, even those who are strongest advocates of the retention of the ovaries. Brennecke (7) would gauge the rapidity with which the retained ovary undergoes atrophy by the duration of the menstrual molimina. Keitler (18) and Holzbach (17) rightly take exception to this view, inasmuch as the menstrual molimina, when present, usually cease after a period varying from six to eighteen months, while it is fairly well established that ovulation persists in the retained ovaries for a much longer period — in the cases of Pronai (24) four and a half years after the hysterectomy. Further, Holzbach (17) draws attention to the findings by Weber, (25) in fifteen ovaries obtained from women long past the menopause. In four instances Weber (25) found follicles in the various stages

of development, and in one case a corpus luteum. But the further argument used by Holzbach (17) regarding women with lactation atrophy, who sometimes are known to conceive without the recurrence of menstruation, is not well taken, because conception may take place as a result of the first ovulation following parturition and before the onset of the subsequent menstruation. We know many women do menstruate regularly during lactation, and we may be justified in assuming that in them the atrophy of the pelvic organs usually associated with that function has reached such a degree in the ovaries as to entirely preclude ovulation.

The crux of the whole question, whether the ovary or ovaries should be removed or left *in situ*, depends upon whether the symptom-complex known as the climacteric syndrome are obviated or lessened by leaving one or both ovaries behind. Undoubtedly at the present time the majority of operators are in favor of conserving the ovaries when the uterus has to be removed in women under 45 years of age. But a study of the literature brings out some very interesting facts regarding this point. For instance, in Mandl and Buerger's (20) monograph, by far the most extensive and carefully prepared article in the literature, it is noted that in a series of 100 cases of hysterectomies in which the ovaries were removed, climacteric symptoms were entirely absent in 23 cases. They were moderate in 26 cases, and severe in 51 cases, of these 51 cases, 2 were 45 years of age, 5 were 46, 3 were 47, 6 were 48, 3 were 49, one was 50, one was 51, and 2 were 52 years old. Thus 23, or 46 per cent, were above 45 years of age, and the nervous disturbances were as severe and the duration, in most of them, was longer than in the younger women. In many instances, they persisted for eight and nine years. A further interesting fact was noted in one case, that of a woman 48 years old, in whom the menopause had become established without any disturbances six months before operation. But a short time after the operation she began to suffer severely from the climacteric syndrome, which persisted for four years. Holzbach (17), in the writer's opinion, draws an erroneous in-

ference from this case, in that he adduces it was an evidence that the ovaries are active after the menopause. On the contrary, it furnishes strong evidence that the climacteric symptoms are not always due to the removal of the ovaries, but are just as likely to be due to the traumatism inflicted upon the pelvic nerves by the operation a view first expressed by Glævecke (14) and accepted by Werth (26) and others. The writer's first case would also support this view. The climacteric symptoms had disappeared years before the second operation for the removal of the cyst, which to the naked eye showed no ovarian tissue, then they reappeared after the second operation and are still present, though in a diminished degree, showing fairly conclusively that they could not have been reproduced by the removal of a cystic degenerated ovary, which practically contained no ovarian tissue. The inference therefore, is very strong that they recurred as a result of the traumatism to the pelvic sympathetic nerves.

It had further been the writer's intention to refrain from drawing any conclusions at this time. But such a course he feels now would not be desirable. Hence he will assume the liberty of giving expression to his opinions based upon a study of the literature upon the experiences of others gained from personal communications and upon his own experiences. In so doing he fully realizes that the accumulated observations of reputable operators during the next few years may place the subject in a different aspect.

1. There is still considerable uncertainty as to which tissue in the ovary is responsible for the production of the "internal secretion."

2. While it is established that the follicles go through the various stages of development in the conserved ovary or ovaries after the uterus has been removed, it is not at all certain that the function of the internal secretion continues uninfluenced by the great changes in the blood supply, and by the traumatism to which the pelvic sympathetic nerves are subjected as a consequence of the operation.

3. It is still a disputed point as to what degree the climacteric syndrome is due to the removal of the ovaries, and to what degree to

the injury to the pelvic nerves incident to the operation.

4. Clinically it has been found that the freedom from the climacteric syndrome in hysterectomized women, in whom the ovaries have been conserved, is only relative to that which obtains in the same class of women in whom the ovaries have been removed. A generous estimate would be 20 per cent in favor of the former.

5. To obtain the benefits claimed by the advocates of conservation the ovaries should be retained at all ages and not limited to those under 45 years, as is done by most of them inasmuch as it has been shown that of the women who suffered most severely from the artificial menopause 23 per cent were over 45 years of age.

6. Subsequent disease of the conserved ovary, such as cystic degeneration, malignant growth inflammatory processes leading to adhesions and pain calling for a second operation does occur in some cases, the number, no doubt, being much larger than would be inferred from the records found in the literature.

7. In view of the foregoing conclusions, the writer is of the opinion that the doubtful clinical advantages accruing from retaining the ovaries in hysterectomy are more than counterbalanced by the risks to which the patient is subjected from subsequent disease and adhesions of the conserved ovaries. The writer would therefore not retain the ovaries in any case of hysterectomy, unless he could leave enough of the lower segment of the uterus with its endometrium to ensure the function of menstruation (Zweifel's method). For in his experience the knowledge imparted to the woman that her ovaries have not been removed has little significance or moral effect, when she learns that she will no longer menstruate.

Since writing the above the following opportunity presented itself of examining microscopically, eighteen months later one of the two ovaries that had been retained in a supravaginal hysterectomy for proclitidia.

Mrs. A. H., age 23, married 4 years, 1 child, three years ago. Admitted to second gynecological service Mt. Sinai Hospital, August 19, 1914.

Sixteen months before she had been operated upon in an out-of-town hospital for procidentia. The operation consisted in an abdominal supravaginal hysterectomy and suturing the stump to the abdominal wall. A few months later the patient noticed that the organs came down as before the operation. On admission there was complete prolapse of the long and large cervix, together with both vaginal walls.

August 21, operation, Longitudinal incision of anterior vaginal wall dissecting bladder from the cervix, opening the peritoneal cavity, severing a long fibrous cord leading to the abdominal wall. Both ovaries were inspected. They were free from adhesions and the left ovary was removed for microscopic examination. The further steps of the operation consisted in suturing the cervical stump after it had been shortened by a liberal excision of the lower part, to the anterior vaginal wall and a very extensive posterior colporrhaphy.

Report from the pathological laparotomy. The specimen of ovary received in fresh state measures $3.5 \times 3 \times 2.5$ cm. A portion of the ovary at the hilum is missing. Grossly there are no abnormalities. The ovary shows several small cysts about the size of a pea, containing clear fluid, and on section, one rather old corpus luteum. Histologically the surface epithelium is missing over the greater portion of the ovary. The tunica albuginea is well developed and the stroma intact and cellular. Follicles in all stages of development are present with well preserved epithelium and ovula. A corpus luteum which is present in the regressive stage. There are several small cysts lined by several layers of epithelium (granulosa cells). The vessels are normal in appearance showing no sclerotic changes or calcification. The gross and histological study shows no evidence of atrophy or degeneration in the ovary.

Commenting upon the foregoing case it must be borne in mind that ideal conditions presented for the preservation of the ovaries, the uterus was about normal size and there was no dislocation of the site of the ovaries as so frequently occurs in the presence of fibroid growths of the uterus.

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OVARIAN TRANSPLANTATION

A REVIEW OF THE LITERATURE AND BIBLIOGRAPHY UP TO AND INCLUDING THE EARLIER MONTHS OF 1915¹

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THE object of this report to the American Gynecological Society at this time is to bring the bibliography of this interesting subject up to date and to present a review of the work done since my last report to this society, presented in May, 1911, which report completed the record to January, 1911.

My first report on this subject, published in 1903 in the *Chicago Medical Recorder*, described two cases of heterotransplantation of the ovaries in human females, and contained a review of the literature. My second report in 1908 was presented to this society, as was also my third one in May, 1911.

The following is a résumé of the work accomplished in attempting to transplant ovaries in the human and animal, as recorded in the literature for the last three years.

W. E. Castle and John C. Phillips (70) reported in *Science*, 1909, that ovaries were removed from an albino guinea pig about five months old and in their stead were introduced the ovaries of a black guinea pig about one month old. The albino upon which the operation had been performed was then placed with an albino male guinea pig and six months later bore two black-pigmented young. In many hundreds of matings of albino guinea pigs observed by the authors only albino young were produced, so there seems no room for doubt that in the case described the black-pigmented young derived their color from the black animal that furnished the ovaries.

Shigeji Higuchi (81) in 1910 described his experiments on rabbits and gave the following conclusions. Ovaries transplanted autoplastically take well, and after more than a year, in spite of different changes, especially a marked decrease in size, all the parts of the ovary still remain and function. The mucous membrane and glands of the uterus become hyperplastic; the muscular wall in

the direction of the mesometrium is of normal thickness, but toward the free side is very much decreased. The mucous membrane of the tubes and vagina is somewhat hyperplastic but not nearly so much so as that of the uterus. Ovaries transplanted from one female to another of the same species after the same length of time are either very much changed, having lost their typical constituent parts, and are atrophied, or else they disappear entirely. The mucous membrane and glands of the horns of the uterus and cervix show pronounced atrophy. The tube atrophies at the same time, the cervix and vagina later. Ovaries transplanted into males were completely absorbed.

W. E. Castle and John C. Phillips (88) in 1911 reported experimental work to disprove Guthrie's theory of foster mother influence in ovarian transplantation. They described seventy-four cases of homoplastic ovarian grafting in guinea pigs and seventeen similar cases in rabbits. Only one grafted animal had young from her grafted tissue, in six other cases the grafted ovaries functioned but did not produce young. Ten animals regenerated their own ovaries and three of these had young. Forty-two showed at postmortem complete atrophy of the genital tract and absence of ovarian tissue. The remainder comprised fifteen cases in which results were not fully determined. Details of the experiments in the various groups of cases are given. In the cases where young were produced they gave no indication in their coloring of foster mother influence.

W. E. Castle (89) again in *Science*, 1911, brought forward evidence to refute Guthrie's claim that the transplanted ovary in fowls functions and that the offspring show evidence of the influence of the foster-mother. He says Guthrie's evidence is insufficient.

C. B. Davenport (90) described six experiments in which there was no evidence

¹ Read before the American Gynecological Society, White Sulphur Springs, May 18 to 1915.

that the engrafted ovary ever became functional; but all the results are in accord with the conclusion that the more or less completely extirpated ovary regenerated and produced an abundance of eggs.

C C Guthrie (91) reported evidence of some influence on offspring from engrafted ovarian tissue. By exchanging ovaries of fowls and breeding the fowls he has obtained results that seem to show that the transplanted ovaries retained their function and the resulting offspring presented evidence of some foster-mother influence.

Hartmann (92) in 1911 discussed Tuffier's work in transplantation of ovaries, including 130 cases on women. His work establishes beyond a doubt the possibility of auto-transplantation of ovaries without suture and without vascular anastomosis, it is only necessary that they be placed aseptically in cellular tissue. But heterotransplants do not as a rule give any results, transplantation of ovaries preserved in cold storage never. Ovarian transplantation, however, does not prevent the development of the menopause. Hartmann finds this in accordance with his own clinical experience. He has never practiced ovarian transplantation, and he still believes that it is more rational to preserve the ovary with its normal connections. He does not think it is justifiable to remove a normal ovary from one woman to transplant to another, nor is it justifiable to transplant a diseased ovary, besides there is the danger of transmitting syphilis with the ovary. He thinks, from Tuffier's work, the operation should be abandoned.

A Libroia (94) described experiments performed on young dogs, some of the transplants were autoplasmic, some homoplasmic. The animals were killed after periods varying from three to nine months and careful histological examination made of the transplanted organs. In those killed after the longer periods there was complete transformation of the ovary into fibrous connective tissue, in those killed earlier the central zone was so transformed, but the peripheral zone showed graafian follicles which however were undergoing cystic degeneration. In no case did he observe a re growth of ovarian par-

enchyma as reported by Limon and Ribbert. He concludes that the transplanted ovary undergoes a slow and gradual transformation into fibrous connective tissue, the process being complete after about a year. The uterus, however, does not show the atrophy that it shows after double oophorectomy. This is due to the fact that the degeneration is so gradual that the body is deprived of the internal secretion of the ovary very slowly and progressively, so that its withdrawal is scarcely noted. Microscopic pictures of the ovaries examined are given. Ovaries were transplanted into various tissues: subcutaneous connective tissue, muscle, spleen.

Charles R Stockard (97) says that from experiments on thirty salamanders it appears that the fate of transplanted tissue depends largely upon the nature of the organ upon which it is transplanted. It grows better on the testis than on any other organ. The next most favorable organ is the liver, though liver-cells soon begin to encroach upon the ovarian mass, replacing and absorbing its cells. On other organs the ovarian tissue undergoes degeneration and absorption within a very limited time. Ovarian tissue implanted on the testis persisted with the stroma in good condition for more than seven months. On the liver it was found to contain ova and stroma after forty five days. On the body-wall, lungs, kidney, and wall of the stomach the tissue disappears within about two weeks; only three indications of the ovarian tissue in more than fifty such transplants were found after forty-five days, and these had almost disappeared.

O Uffreduzzi (100) describes experiments on rabbits and guinea pigs, designed to transplant ovary into the cavity of the uterus or into its wall, for the sake of rendering conception possible when the tubes are occluded, as in salpingitis. He concludes from his experiments that the ovary cannot be made to ovulate directly into the uterus, but as far as the transplanted ovaries are concerned they preserve their vitality (Autoplasmic grafts, experience extending over two years).

H S Davidson (101) reports transplantation of the ovary in the human being with three cases. He transplanted ovaries into

the rectus muscle which was sewed over them with fine catgut. None of the patients had any recurrence of pain after removal of ovaries. In Case 1 the graft was unsuccessful, as the patient had distinct symptoms of menopause after the operation. In Case 2 a fibroid appeared after the operation. Without the presence of ovarian tissue somewhere, it is hardly probable that a fibroid would appear in the atrophied uterus that always follows double oophorectomy. In Case 3, examination a year after the operation showed that the ovarian grafts had definitely grown and were functioning. The results are not conclusive proof that ovarian grafting is of great importance but they show that it is certainly worth trial.

Emil Engel (103) stated that ovarian transplantation is justified as a treatment of symptoms of menopause in castrated women. He describes the following case: Woman of 27, both ovaries and uterus had been removed. The operation was followed by severe symptoms of menopause and the patient became so despondent that she threatened suicide. It was decided to transplant an ovary. The ovary was obtained from a case operated upon for myoma and was transplanted into the stump of the uterus per vaginam. Normal health was restored. Engel thinks that good results could be obtained in similar cases by transplantation of ovaries. If only a few women were benefited by this procedure the operation would be completely justified.

W. Harms (104) in a series of experiments on transplantation of ovaries to a different species, reported failure.

M. Kawasoye (107) asks "Can a transplanted ovary develop the same as one left in the normal position?" From his experiments on rabbits which are described in detail, the author concludes that even when transplanted ovaries take well they undergo atrophic changes, which may be attributed to the diminished blood supply. These changes may be observed to a much less degree in ovaries remaining in position. It is, therefore, necessary in extirpation of the adnexa to leave the whole ovary or as much of it as possible, *in situ*, with the least possible

disturbance of the blood vessels supplying it. Two colored plates showing microscopic pictures of ovaries are given.

A. Louise Mellroy (109), in discussing ductless-gland secretions, devoted a portion of her paper to ovarian transplantation and discussed the work of other authors.

G. Schone (110) reviewed the literature of the subject and concluded, in reference to transplantation in animals that in guinea pigs and rabbits homoplastic ovarian transplantation occasionally succeeds though he questions whether the transplant persists permanently in animals that are not blood relatives. With reference to human transplantation he thinks the cases reported show that it may occasionally succeed.

E. Steinach (111) described some surgical techniques in which males were transformed into female secondary sexual characters by removing the testicles and implanting ovaries. The younger the animals were when the implantation was done the greater the change in the sexual character.

W. I. Castle and John C. Phillips (114) reported in 1913 further experiments on ovarian transplantation.

There were 141 female guinea pigs grafted with foreign ovaries. About one hundred of these mated with males long enough to give definite indications of their ability to produce young. Only three actually produced young, but in seven others engrafted ovarian tissue persisted for many months and was demonstrated post mortem. In three cases in which young were produced the genetic characters of the mother were exaggerated, but never those of the graft. In 57 cases of the 141 no ovarian tissue whatever was found post mortem the castration having been immediately successful but the transplanted ovaries having failed to persist for any length of time in the foreign body. The small percentage of successful transplantations indicates that transplantation will not be practically successful unless some means can be discovered of increasing the tolerance of the body for foreign tissue. The authors have considered the possibility of increasing the tolerance by keeping the tissue to be transplanted for a time in an artificial nutrient

medium or even in serum from the animal to be grafted, allowing a preliminary adjustment to the new environment, but they have not had an opportunity to try such methods.

DeRouville (115) reported as follows: Madame B, age 23. Nervous crisis, ovaries tender and painful, coitus impossible. The ovaries were removed and grafted under the skin of the abdominal wound. The patient's health was restored to normal, menses after the first two months normal. The ovaries lived and developed in the new situation for 18 months, at the end of which time they were removed. Microscopic examination showed the ovaries living, the graafian follicles in course of development, and a large hypertrophied corpus luteum in process of degeneration. After the removal of the ovaries the menses and intermenstrual discharge of blood stopped, showing that the menses had been produced by the transplanted ovaries and not by any remnants of ovarian tissue left *in situ*, as often claimed in such cases.

A Louise McIlroy (116) in 1913 discussed the question of ovarian grafting, describing her experiments on rabbits. The most successful grafts were found among those implanted into a vascular organ such as the kidney or spleen. Ultimate degeneration took place, and absorption changes were most noticeably shown in the follicles. Grafts from the patient's own ovaries were more successful than those from another individual. The grafts became absorbed in time, but they served their purpose in assisting the organism to become gradually adapted to the changes in metabolism which occur when any interference takes place in the equilibrium maintained by the ductless glands.

S. Voronoff (110) gave a most instructive account of experiments he had done in ovarian grafts in sheep. Each experiment comprised operations on two ewes. Under local anesthesia he removed the ovaries of one and substituted the ovary of another ewe. In practically every case the ewes bore healthy lambs, and were really not much affected by the operation. Six of the ewes operated on two years ago and four ewes one year ago were alive and well.

Beckwith Whitehouse (121) a year ago demonstrated a patient upon whom he had done heteroplastic ovarian grafting; i.e., the transplantation of an ovary from one patient to another. He now shows a case of autoplasmic grafting in which the result has been entirely successful. The appendages had to be removed for old standing inflammatory disease. A portion of the left ovary was grafted into the abdominal wall. The patient menstruated regularly a year after. A careful search was made for accessory ovary at the time of operation. Whitehouse thinks it much better to implant small pieces of ovary, "seedling grafts," than to try to transplant the entire organ. The best site is the rectus muscle or the subperitoneal tissue. Indicated in cases like his of old inflammatory disease, also in cases of severe dysmenorrhea.

DeRouville (124) reported nine cases of autoplasmic grafting of ovaries. From his experience it is his opinion that autotransplantation of ovaries is very unfavorable. He had only one really good clinical result (Case 3), one questionable result (Case 4), one favorable but of very short duration (Case 8). Except in Case 3 there was more or less rapid atrophy of the grafts. He concluded that, under the technical, anatomical, and clinical conditions under which he operated, ovarian grafts were not capable of permanent function and even in the cases that were apparently most favorable his results were the same as those of Schiff with thyroid grafts in animals, i.e., the patients were deprived slowly and gradually of their ovarian secretion. He still thinks, however, that with improvement in technique and increased knowledge of anatomical and physiological conditions the results may be improved.

G. Frank Lloyd-Lyon (126) in an article, "Implantation of the Generative Glands and its Therapeutic Possibilities," describes (1) implantation of testicle in himself, (2) implantation of ovary from girl of sixteen, 12 hours after death into woman of 59 suffering from nervous disturbance, ovary implanted into labium majus with improvement in strength and nervous condition, (3) transplantation of testicle, (4) transplantation of ovary for dementia praecox, (5) transplanta-

tion of testicle into woman for dementia præcox; (6) transplantation of testicle

He performed his transplantations into the preperitoneal space, the cul de-sac of Douglas (extraperitoneally), the labium majus, beneath the mammary gland, the pubic region, the rectus muscle. He favors "exposed" implantation. "The methods of Tuffier and of Martin of implantation within the pelvis and rectus muscle of ovarian tissue from living donors is a procedure entirely different from that under discussion. Heterointraperitoneal implantation within the pelvis is unnecessary and has an element of danger."

Tchernischoff (127) described in detail his technique and stated that in autoplasmic transplantation of the ovary in sexually mature rabbits the transplanted ovaries take in their new location and fulfill their functions for a long time. Homoplastic transplantation was performed on twelve rabbits and showed that the transplanted ovary may take and function for a while, but for a much shorter time than in autoplasmic transplantation.

George F. Dick and Arthur H. Curtis (102) say that autotransplantation of ovaries is successful in a rather small percentage of cases. Homotransplantation is considerably less successful. Attempts to produce experimental rickets by means of transplantation of ovaries were unsuccessful.

One of the most important contributions on this subject, in point of number of cases operated upon, is the several reports made by Professor Tuffier of Paris, whose various contributions may be summarized as follows:

"During the past eight years, from November 15, 1906, to July 15, 1914, I have performed two hundred and four operations thirty five of which cannot be considered in this paper as they were performed only recently." This paper refers to a contribution read at the London meeting of the Clinical Congress of Surgeons of North America.

In speaking of homografting considerations, namely, from one human individual into another, he states "I have performed this operation twenty four times under the most favorable circumstances, but it did not

prove successful. I have performed seven heterograftings immediately after the removal of an ovary, or after the gland had been preserved in cold storage from one hour to forty-four days, and the operation has never given me a single functional result."

In speaking further of homografting he says: "I have transplanted an ovary from one young woman to another who presented, after the removal of ovaries and tubes, very severe symptoms simulating change of life. There was every chance for success as the patients were of the same age and of the same complexion. I should have been successful, but the blood of the patients was either hamolyzed or agglutinated on coming in contact. The results were nil."

However, he states, "I think with an improvement in technique we may later succeed in this procedure because the mechanism of absorption in such cases is well known. It is the same as for any foreign element—the foreign element being destroyed by the macrocytes. If we could prevent the macrocytes from attacking the grafted ovaries, it would be possible to obtain success. We already have learned from Carrel's experiments that the transplantation of limbs always gives a better result when the animal is infected. It is probable that the macrocytes in infected cases are occupied in struggling with the microbes and, consequently, are less liable to attack the grafted limb. While it is not within the province of surgery to produce infection in the human body, we do hope that some chemical substance will be discovered that may be used to protect the grafted ovary." Speaking of autografting he says "I have performed 145 of these operations. Two circumstances under which the operation may be performed may be cited. First, in total hysterectomy and transplantation of one or both ovaries in whole or in part. Eighty four operations were performed in this way. The graft takes and every month it increases in size. This continues for two or three years, but without any benefit to the patient. Second, I perform this operation in salpingitis, where the uterus remains in place. Sixty five operations have been performed following this technique."

Tuffier discusses this whole subject under —

1. Justification for this operation
2. Surgical technique
3. Results.
4. Indications and future possibilities

He feels that the symptoms of menopause following the removal of appendages can be relieved if a portion of the ovaries can be preserved and transplanted

His results, he feels, justify the performance of this operation. His technique is extremely simple. "I take the ovary, or a portion of it, in a sterilized compress, the peritoneum of the abdominal wall is supported by the finger deeply inserted into the adipose tissue, and the ovary put into this opening and left there. When the glands are surrounded by adhesions they are very often torn in freeing them, their surface becomes irregular, and they appear wasted. Often, also, they are sclerosed or contain cysts, but even in such instances the glands may be made use of and the results are good. If the glands are not quite aseptic, they may be dipped into tincture of iodine or passed through the flame of a lamp. The result in these cases, however, is not so good. In cases of cystic change the ovaries must be opened before grafting. A small section of the pedicle of the gland is sometimes needed to enlarge the surface for future adhesions. In some recent cases the glands were divided into equal parts and implanted separately. This is done in order to obtain the smaller grafts and larger surfaces for adhesions."

Results He summarizes under —

- a, clinical,
- b, anatomical, and
- c, physiological

Clinical After the transplantation where the uterus is left in place, the ovary remains unaltered for three or four months and seems to lie dormant. Sometimes it is a little tender, and the patient has all the symptoms of change of life. But after a while the ovary becomes active, enlarges, and is sometimes painful for five or six days, whereupon all symptoms subside and menstruation reappears. Generally the congestion of the ovary precedes menstruation by five or ten days. On the same day when menstruation

has commenced, all the symptoms of menopause disappear entirely. It is certain that with the grafting of an ovary the normal condition of the patient can be maintained. Speaking of the danger of the operation, he says, "This operation presents no more danger than does classical hysterectomy." Speaking more definitely of the menstruation results, he says: "Of the sixty-five patients upon whom I performed autografting operations without hysterectomy, I have interviewed thirty-seven from one to six years after operation, and thirty-two had their periods regularly. In the five cases which did not have regular periods, two important points were noticed. First — the patients were either more than forty years of age, or second — they were septic cases where it was necessary to dip the graft into tincture of iodine." He differentiates menstruation following these operations due to a portion of an ovary being left in the abdomen, and due to the graft, by the following observation: "When menstruation is dependent upon the part of the ovary left in the abdomen (1) it appears two months after the operation, and I have never seen such a quick result from a graft; (2) the grafted ovary does not become enlarged just preceding menstruation, and it is curious to note that every time one ovary has been grafted and the other left in the abdomen, the graft never produces menstruation."

Under anatomical considerations, he states that grafted ovaries are the cause of menstruation by the following illustration: Transplant removed after four and one half years. Macroscopically, a corpus luteum is found. Another transplant removed after three years contained a cyst the size of a nut; the veins and two of the arteries were the size of the finger. This case also contained a corpus luteum. Another was removed two years after regular menstrual flow had been established. The epithelial zone was regular, except where small hemorrhages were found.

In summarizing his future possibilities, he says: "All recent cases of salpingitis, and all malignant diseases contra indicate the procedure. After the fortieth year it is unnecessary. Another local contra indication

tion of testicle into woman for dementia præcox; (6) transplantation of testicle

He performed his transplantations into the preperitoneal space, the cul de-sac of Douglas (extraperitoneally), the labium majus, beneath the mammary gland, the pubic region, the rectus muscle. He favors "exposed" implantation "The methods of Tuffier and of Martin of implantation within the pelvis and rectus muscle of ovarian tissue from living donors is a procedure entirely different from that under discussion. Heterointraperitoneal implantation within the pelvis is unnecessary and has an element of danger."

Tschernischoff (127) described in detail his technique and stated that in autoplasmic transplantation of the ovary in sexually mature rabbits the transplanted ovaries take in their new location and fulfill their functions for a long time. Homoplasmic transplantation was performed on twelve rabbits and showed that the transplanted ovary may take and function for a while, but for a much shorter time than in autoplasmic transplantation.

George F. Dick and Arthur H. Curtis (102) say that autotransplantation of ovaries is successful in a rather small percentage of cases. Homotransplantation is considerably less successful. Attempts to produce experimental rickets by means of transplantation of ovaries were unsuccessful.

One of the most important contributions on this subject in point of number of cases operated upon, is the several reports made by Professor Tuffier of Paris, whose various contributions may be summarized as follows:

"During the past eight years, from November 15, 1906, to July 15, 1914, I have performed two hundred and four operations thirty-five of which cannot be considered in this paper as they were performed only recently." This paper refers to a contribution read at the London meeting of the Clinical Congress of Surgeons of North America.

In speaking of homografting considerations, namely, from one human individual into another, he states "I have performed this operation twenty-four times under the most favorable circumstances, but it did not

prove successful. I have performed seven heterograftings immediately after the removal of an ovary, or after the gland had been preserved in cold storage from one hour to forty-four days, and the operation has never given me a single functional result."

In speaking further of homografting he says "I have transplanted an ovary from one young woman to another who presented, after the removal of ovaries and tubes, very severe symptoms simulating change of life. There was every chance for success as the patients were of the same age and of the same complexion. I should have been successful, but the blood of the patients was either hamolyzed or agglutinated on coming in contact. The results were nil."

However, he states, "I think with an improvement in technique we may later succeed in this procedure, because the mechanism of absorption in such cases is well known. It is the same as for any foreign element—the foreign element being destroyed by the macrocytes. If we could prevent the macrocytes from attacking the grafted ovaries, it would be possible to obtain success. We already have learned from Carrel's experiments that the transplantation of limbs always gives a better result when the animal is infected. It is probable that the macrocytes in infected cases are occupied in struggling with the microbes and, consequently, are less liable to attack the grafted limb. While it is not within the province of surgery to produce infection in the human body, we do hope that some chemical substance will be discovered that may be used to protect the grafted ovary." Speaking of autografting he says "I have performed 145 of these operations. Two circumstances under which the operation may be performed may be cited. First, in total hysterectomy and transplantation of one or both ovaries in whole or in part. Eighty-four operations were performed in this way. The graft takes and every month it increases in size. This continues for two or three years, but without any benefit to the patient. Second, I perform this operation in salpingitis, where the uterus remains in place. Sixty-five operations have been performed following this technique."

Tuffier discusses this whole subject under —

1. Justification for this operation.
2. Surgical technique
3. Results
4. Indications and future possibilities

He feels that the symptoms of menopause following the removal of appendages can be relieved if a portion of the ovaries can be preserved and transplanted

His results, he feels, justify the performance of this operation. His technique is extremely simple. "I take the ovary, or a portion of it, in a sterilized compress; the peritoneum of the abdominal wall is supported by the finger deeply inserted into the adipose tissue, and the ovary put into this opening and left there. When the glands are surrounded by adhesions they are very often torn in freeing them, their surface becomes irregular, and they appear wasted. Often, also, they are sclerosed or contain cysts, but even in such instances the glands may be made use of and the results are good. If the glands are not quite aseptic, they may be dipped into tincture of iodine or passed through the flame of a lamp. The result in these cases, however, is not so good. In cases of cystic change the ovaries must be opened before grafting. A small section of the pedicle of the gland is sometimes needed to enlarge the surface for future adhesions. In some recent cases the glands were divided into equal parts and implanted separately. This is done in order to obtain the smaller grafts and larger surfaces for adhesions."

Results. He summarizes under —

- a, clinical,
- b, anatomical, and
- c, physiological

Clinical. After the transplantation where the uterus is left in place, the ovary remains unaltered for three or four months and seems to lie dormant. Sometimes it is a little tender, and the patient has all the symptoms of change of life. But after a while the ovary becomes active, enlarges, and is sometimes painful for five or six days, whereupon all symptoms subside and menstruation reappears. Generally the congestion of the ovary precedes menstruation by five or ten days. On the same day when menstruation

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